No. 15714

United States Court of Appeals for the Ninth Circuit

TALON, INC., Appellant,

vs.

UNION SLIDE FASTENER, INC., Appellee.

UNION SLIDE FASTENER, INC., Appellant,

vs.

TALON, INC., Appellee.

Transcript of Record

In Five Volumes

VOLUME V.

Book of Exhibits

Pages 1659 to 2007, inclusive)

Appeal from the United States District Court for the Southern District of California, Central Division

Phillips & Van Orden Co., Fourth and Berry Sts., San Francisco, Calif.—3-5-58

No. 15714

United States Court of Appeals

for the Ninth Circuit

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UNION SLIDE FASTENER, INC., Appellee.

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Appeal from the United States District Court for the Southern District of California, Central Division

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Exhibits for Plaintiff:

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Exhibits for Defendant—(Continued):

PLAINTIFF'S EXHIBIT No. 1

N. J. Poux Patent No. 2,078,017

Filed Jan. 3, 1931 Patented April 20, 1937

April 20, 1937. N. J. POUX 2,078,017

METHOD OF MAKING SEPARABLE FASTENERS

Original Filed Jan. 3, 1931

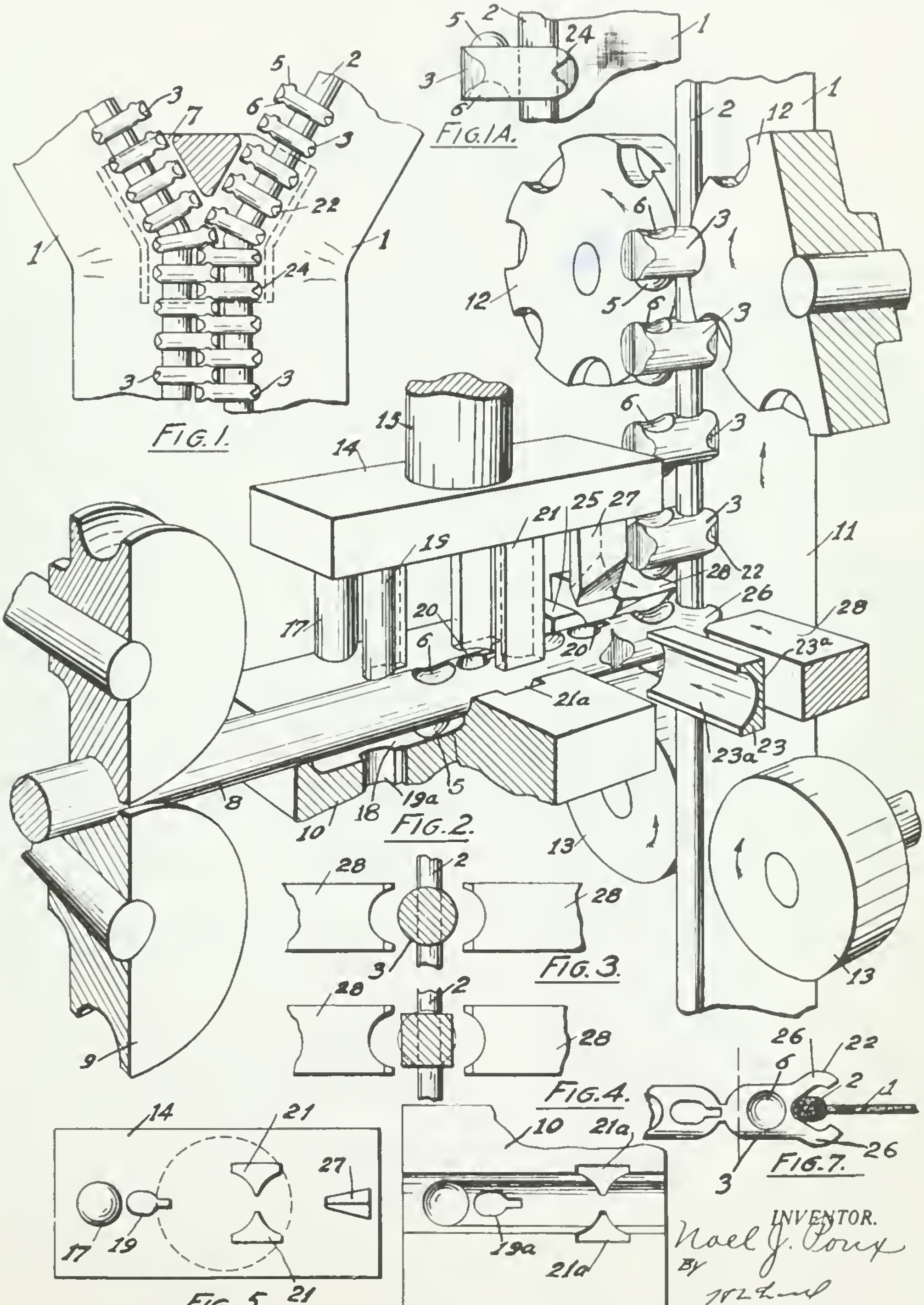

FIG. 1A.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 7.

FIG. 5.

FIG. 6.

INVENTOR.

Noel J. Poux

By

ATTORNEYS.

Patented Apr. 20, 1937 2,078,017

UNITED STATES PATENT OFFICE

2,078,017

METHOD OF MAKING SEPARABLE FASTENERS

Noel J. Poux, Meadville, Pa., assignor, by mesne assignments, to Hookless Fastener Company, Meadville, Pa., a corporation of Pennsylvania

Application January 3, 1931, Serial No. 506,363
Renewed March 10, 1937

18 Claims. (Cl. 153—1)

The present invention is directed to the method of making slide fastener members, particularly of the type having attaching jaws, or prongs which are set astride a fastener tape and secured thereon and which members are provided with interlocking projections and recesses at their free ends. Heretofore the common practice of making such members has been to form the members individually and then secure them on the tape. In the present invention a plurality of members are formed with recesses and projections on opposite sides of each member, the exterior edges of the members fashioned, the interior surfaces of the prongs, or jaws, shaped and the members severed. Preferably the severance is between the jaws of one member and an adjacent member and the members are preferably severed as one of the members is united with the tape. In this way the fabrication is simplified, the operations made more certain and refinements in the members may be accomplished. Features and details of the invention will appear from the specification and claims.

A preferred embodiment of the apparatus with which the method may be practiced is illustrated as follows:—

Fig. 1 shows a plan view of the fastener.

Fig. 1*a* a side elevation of one of the interlocking members.

Fig. 2 a perspective view, parts being broken away, showing the apparatus.

Fig. 3 a side elevation of the jaw closing mechanism.

Fig. 4 a modification of the jaw-closing dies.

Fig. 5 a bottom view of the punches.

Fig. 6 a plan view of the punch-receiving dies.

Fig. 7 a plan view of the end of the rod prior to the severance of the member and the closing of the jaws.

1—1 mark the stringers, 2 ribs along the edges of the stringers, and 3 interlocking members secured to the edges of the stringers, these interlocking members having projections 5 and recesses 6 on opposite sides of the members and these recesses and projections are swung into and out of engagement in the usual manner through the action of a slider 7.

In the making of the fastener the members are made from a rod or strip 8. This rod is intermittently fed forward by rolls 9. It traverses the lower punching die 10.

A stringer 11 is arranged in the path of the rod. This stringer is intermittently advanced through the action of the rolls 12.

The rolls also give the jaws the final squeeze. Preferably the action of the rolls involves the engagement of the attached members 3. Tension rolls 13 are provided through which the stringer is fed, these rolls being subjected to some resistance so as to properly tension the stringer.

The punches are carried by a head 14 from a plunger 15. This plunger is operated through any ordinary punch press (not shown). A punch 17 is carried by the head 14 and upon the depression of the head indents the rod forming the recess 6. At the opposite side of the rod, a projection 5 is formed, the die 10 being provided with a recess 18 to receive the projection.

With the next advance of the rod a key-hole shaped slot 20 is formed by a similarly shaped punch 19, the punch extending through the material and forcing the same through an opening 19*a* in the die, this operation removing the intervening material between the jaws. With the next advance of the rod punches 21 cut rounded notches in the rod at the rear of the key-hole slots. These notches, using the strip in the form of the rod shown, outline the exterior edges of the fastener members. The rounded notches formed by this action give a rounded end 22 to the members so that they may be more readily operated upon by the slider. The punches 21 operate in die openings 21*a*. With the next forward movement of the rod the key-hole shaped openings are advanced to the position opposite the cutter 23. This cutter operates in an interval or dwell between the forward movement of the rod and the descent of the punches. It has a concave cutting surface on one face and preferably a plane cutting surface 23*a* on the opposite face. It operates in connection with a die 25 at the opposite side of the rod. The concave cutting surface forms a rounded end 24 (see Fig. 1*a*) and the plane cutting face leaves the free end of the interlocking member square with the projection and recess sides of the member. The cutter 23 operates and severs jaws 26 of the second fastener element from the end in Fig. 7 forming an open slot at their ends and in the same operation severs the end fastener element from the second one from the end in Fig. 7. A spreader 27 spreads these jaws with the next reciprocation of the head, shaping the jaws, particularly the inner edges of the jaws, to the form shown in Fig. 7. With the next forward movement of the rod these jaws are advanced into position over the rib 2 on the stringer and simultaneously with, or slightly before, the cutters operate to sever the member, closing dies 28 operate upon the open jaws to close them, pressing them into clamping engagement with the rib.

With each cycle of the operation the feed rolls 12 advance, thus carrying the member which has been clamped in position and severed from the rod to a position above the plane of the rod so as to place the stringer in position to receive the next successive member. In this way the added handling incident to a forming of the members prior to their engagement with the stringer is avoided.

While the rod 3 so far as described is round in cross section and I have referred to the recess and projection sides of the member as that portion of the member involving the surfaces included circumferentially in the parts occupied by the recess and projection and extending axially therefrom in Fig. 4 I have shown the rod in square form. This may be used where it is desired to have interlocking members of this cross section and the dies 28 under these conditions will fashion the jaw end of the members as desired. As indicated in Fig. 4 it would give the jaw end of the clamps a round cross section and the free end of the member may retain a shape having parallel plane sides for the recess and projection.

It will be noted that while the rod is still integral the recesses and projections of the members are formed for a plurality of members and the intervening material is removed forming the jaws, or prongs for a plurality of members and after completely forming this plurality of members one member is severed from another. Thus in the rod as shown recesses for three distinct members are formed and the exterior edges of these members are also formed. Jaw slots for three distinct members are formed while the parts are integral, and the exterior surfaces of the jaws, or the exterior edges on a plurality of the members are formed by cutters 21 prior to the severance of one of those members from another and the interior surface of the jaws is shaped by the spreader while the two last members are still united and the jaws are severed one from the other with the severance of one member from another. This affords a simpler manner of fabricating the members, maintaining them in proper relation and permits, if desired, a greater range of finishing of the members than with practices heretofore used. It also simplifies the transfer, or assembly to the tape and while in the present exemplification and preferably the jaws are moved to a position astride the tape, in the broader phases of the invention it is only necessary that there should be relative movement of the jaws and tape to bring the tape within the jaws.

By forming the strip with a plurality of interlocking members formed, or partially formed, and with a major portion of the side edges of the members unobstructedly exposed it is possible to finish these edges and portions of the members with greater facility. As shown, this adaptability is utilized in the convenient arrangement of the cutting tools 23. By reason of this unobstructed edge the cutting tools may be made with the concave cutting surfacs 23a giving to the jaw end of the members an eased or rounded shape.

The connection between the members is also within the sides of the members and this facilitates the advance of the members with relation to the punches, and the integral connection gives a greater strength to the strip in handling and presenting it to the fabricating tools.

What I claim as new is:—

1. The method of forming separable fasteners which consists in forming interlocking member jaws on the end of a rod by removing intervening material; feeding the rod and advancing the member jaws while integral with the rod to move the jaws to a position to straddle the edge of a fastener stringer; closing the jaws; and severing the member from the rod.

2. The method of forming separable fasteners which consists in forming interlocking member recesses and projections along side faces of a rod and also jaws on the end of the rod by removing intervening material; feeding the rod and advancing the member jaws while integral with the rod to move the jaws to a position to straddle the edge of a fastener stringer; closing the jaws; and severing the member from the rod.

3. The method of forming separable fasteners which consists in forming interlocking member recesses and projections along side faces of a rod and also jaws on the end of the rod by removing intervening material and with a rib-receiving recess within the jaws; 'feeding the rod and advancing the member jaws while integral with the rod to move the jaws to a position to straddie the edge of a fastener stringer; closing the jaws; and severing the member from the rod.

4. The method of forming separable fasteners which consists in forming successively interlocking member jaws on the end of a rod by removing intervening material; feeding the rod and advancing the member jaws while integral with the rod to move the jaws to a position to straddie the end of a fastener stringer; closing the jaws; severing the member from the rod; and advancing the stringer transversely to the direction of movement of the rod to place the members thereon.

5. The method of forming separable fasteners which consists in forming interlocking member jaws at the end of a rod; spreading the jaws; feeding the rod and advancing the member jaws while integral with the rod to move the jaws to a position to straddle the edge of a fastener stringer; closing the jaws; and severing the member from the rod.

6. The method of forming separable fasteners which consists in forming interlocking recesses and projections along side faces of a rod and also jaws on the end of the rod; and severing the member thus formed from the rod.

7. The method of forming separable fasteners which consists in forming interlocking recesses and projections along side faces of a rod and also jaws on the end of the rod; spreading the jaws; and severing the member thus formed from the rod.

8. The method of forming separable fasteners which consists in forming interlocking recesses and projections along side faces of a rod and also jaws on the end of the rod by removing the intervening material; and severing the member thus formed from the rod.

9. The method for the production of metal elements for sliding clasp fasteners from strips, which consists in cutting in a metal strip of a width equal substantially to one of the plane dimensions of the finished element, limb forming slits disposed intermediate the edges of the strip and lengthwise thereof, said slits being spaced apart a distance sufficient to provide a single slit in each element portion of the strip and with the slits opening through an edge of the finished element, and alternately spreading the element portions at opposite sides of the slits to provide cloth engaging limbs and severing said element portions from the strips.

10. The method for the production of metal elements for sliding clasp fasteners from strips, which consists in cutting in a metal strip of a width equal to one of the plane dimensions of the finished element spaced apart limb forming slits extending lengthwise of the strip and intermediate the lateral edges of the same, said slits disposed in each element portion of the strip with one end of the slit opening through an edge portion of the finished element, and alternately spreading the limbs of each element portion and severing the portion from the strip whereby to free the limbs of succeeding element portions.

11. The method for the production of metal elements for sliding fasteners from strips, which consists in cutting in a metal strip of a width equal to one of the plane dimensions of the finished element, limb forming slits spaced apart a distance to provide a limb in each successive element to be cut from the strip, spreading the free limb of the end element for receiving a cloth strip or the like, and severing the end element from the strip.

12. The method for the production of metal elements for sliding fasteners from strips, which consists in cutting in a metal strip of a width equal to one of the plane dimensions of the finished element, limb forming slits spaced apart a distance to provide a limb in each successive element to be cut from the strip, spreading the limbs of the elements, and severing the elements from the strip.

13. The method of producing sliding fastener elements from a metal strip, which consists in cutting slits at spaced intervals in a metal strip of a width equal to one of the plane dimensions of the finished element, spreading apart the limbs of the elements at opposite sides of the slits, and severing the strip at spaced lengths to provide elements each having a slit therein opening through an edge thereof.

14. The method of producing sliding fastener elements from a metal strip, which consists in cutting slits in a metal strip of a width equal to one of the plane dimensions of a finished element with the slits spaced apart a distance to provide a slit in each element when severed from the strip and with the slits disposed to open through one edge of their respective elements when severed from the strip, opening the slits of the successive end elements to spread the limbs of the elements apart at the end of the strip, and severing the elements successively from the strip.

15. The method of producing sliding fastener elements from a metal strip, which consists in cutting in a metal strip of a width of the finished fastener elements, spaced apart lengthwise extending slits one for each element of the strip and with the slit in the end element opening through the end of the strip, opening the end slit of the end element by spreading the element parts at opposite sides of the slit for the reception of a piece of cloth, closing said slit by bending said element parts back toward initial position to clamp the element to the cloth, and then transversely cutting the strip with the cut intersecting the outer end of the next adjacent slit to sever the cloth attached element from the strip and free the end of the next adjacent slit.

16. The method of forming separable fasteners which consists in forming a plurality of interlocking member recesses and projections and also jaws on a blank with the members connected end to end and with the connections between the members within the outer walls of the members; advancing the jaws of an end member astraddle the edge of a fastening stringer; closing the jaws; and separating the member from the succeeding member.

17. The method of forming separable fasteners which consists in forming on a long strip of material an interlocking member with recesses and projections and also jaws, placing said jaws astride the edge of a tape while the member is integral with the strip, closing the jaws, and severing the member from the strip.

18. The method of forming separable fastener elements of the class described which consists in providing an elongated piece of material with rounded side portions, operating on said material to provide interlocking projections and recesses and a tape receiving recess, and finally severing the fastener member so formed from the piece of material while retaining the original rounded surface of said side portions in the sides of the finished fastener member.

NOEL J. POUX.

PLAINTIFF'S EXHIBIT No. 3

D. Silberman Patent No. 2,437,793

Filed Sept. 23, 1944 Patented March 16, 1948

March 16, 1948. D. SILBERMAN 2,437,793

ZIPPER MANUFACTURING MACHINERY

Filed Sept. 23, 1944 10 Sheets-Sheet 1

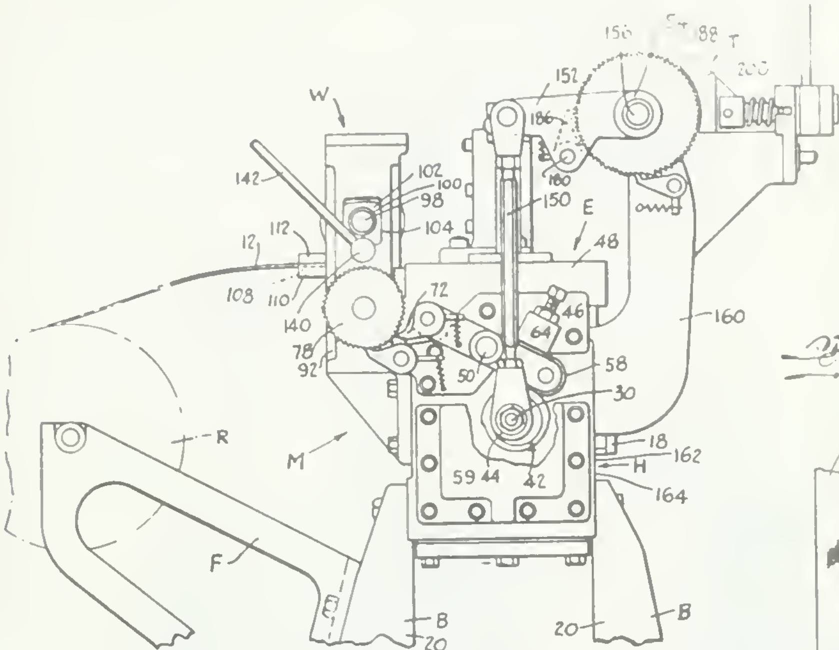

Fig. 1.

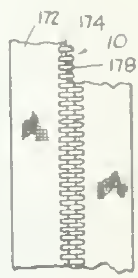

Fig. 1a.

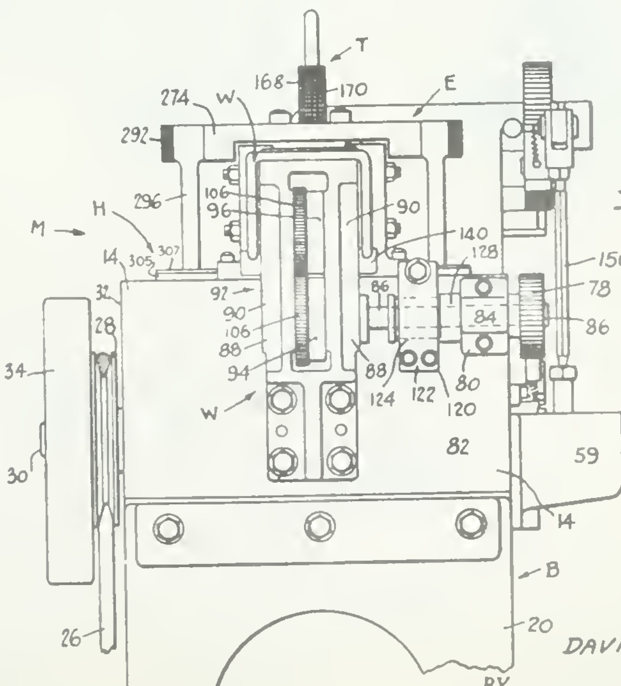

Fig. 2.

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March 16, 1948. D. SILBERMAN 2,437,793

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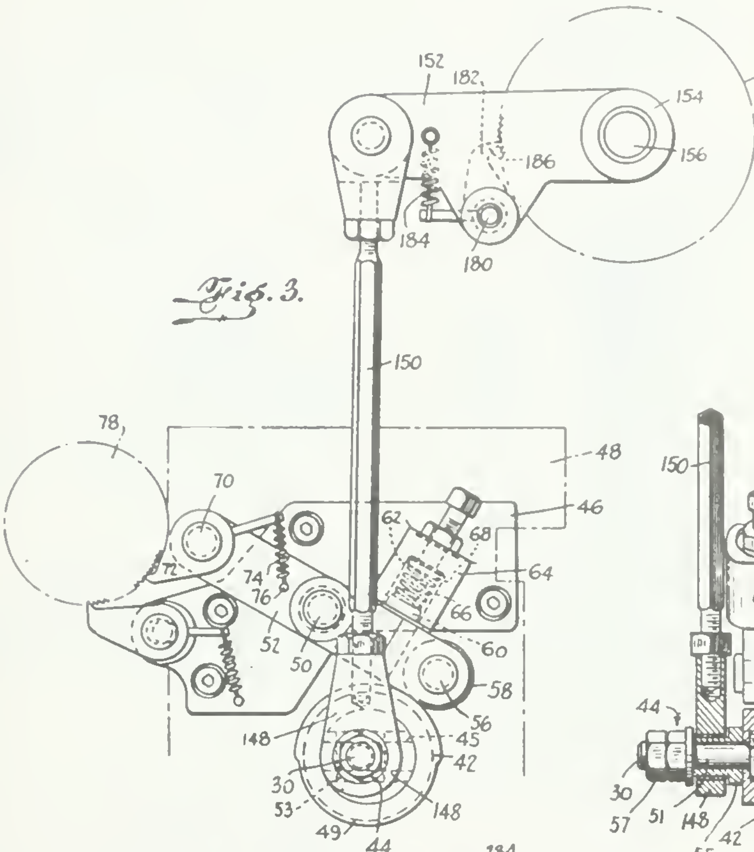

Fig. 3.

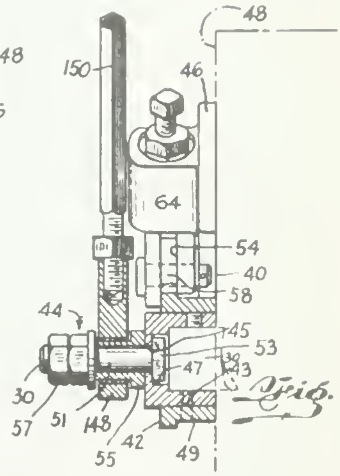

Fig. 4.

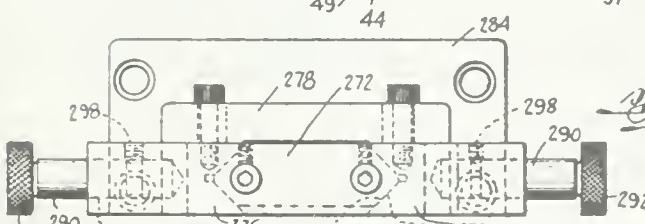

Fig. 6.

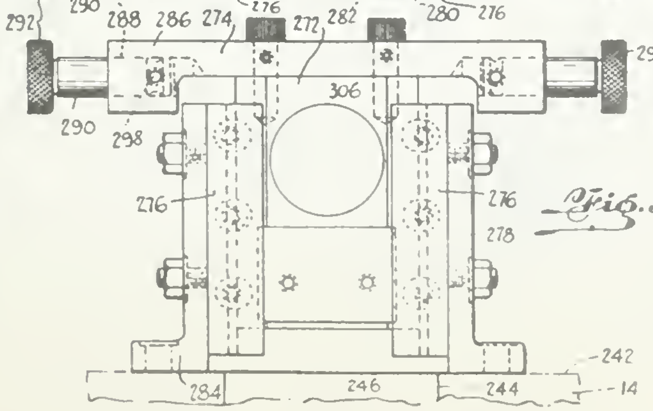

Fig. 5.

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ZIPPER MANUFACTURING MACHINERY

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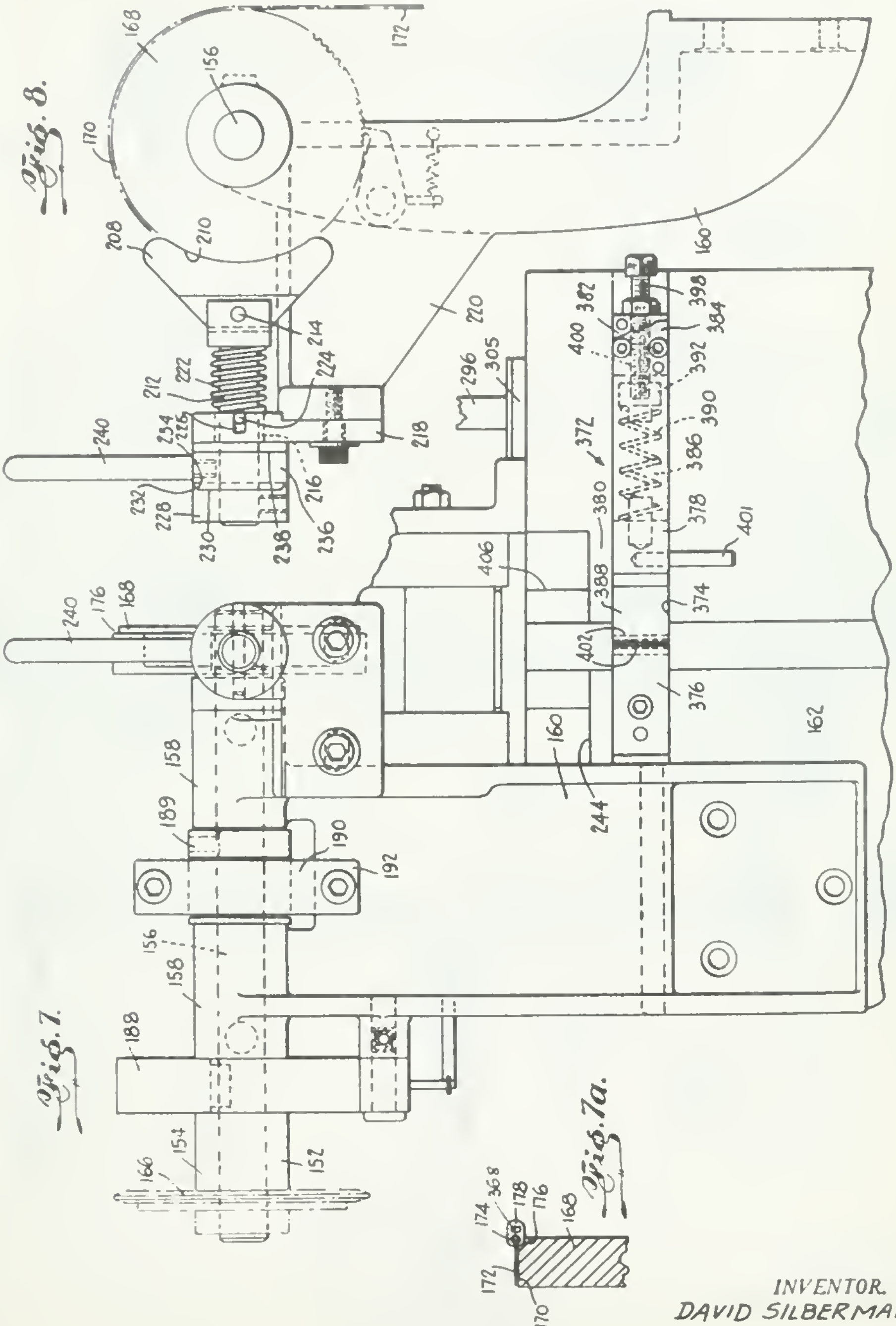

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ZIPPER MANUFACTURING MACHINERY

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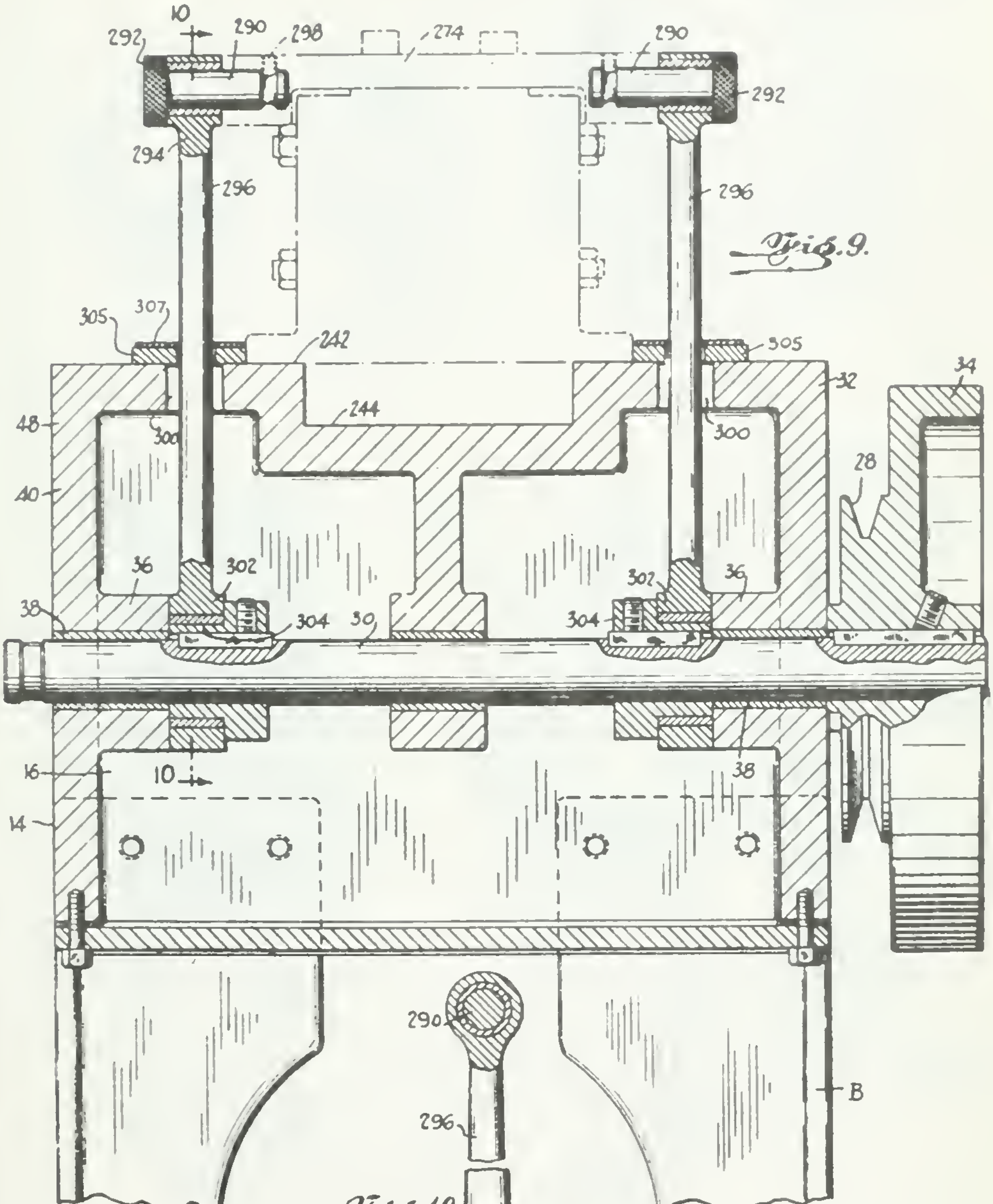

Fig. 9.

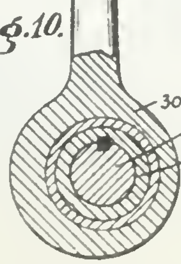

Fig. 10.

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ZIPPER MANUFACTURING MACHINERY

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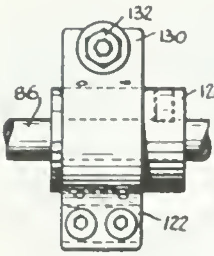


Fig. 14.

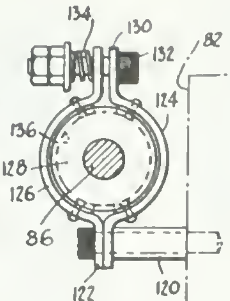
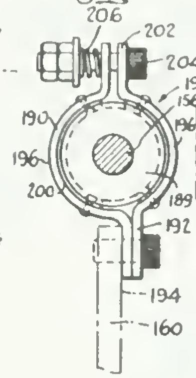


Fig. 13.

Fig. 15.



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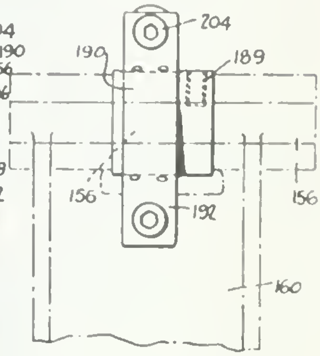

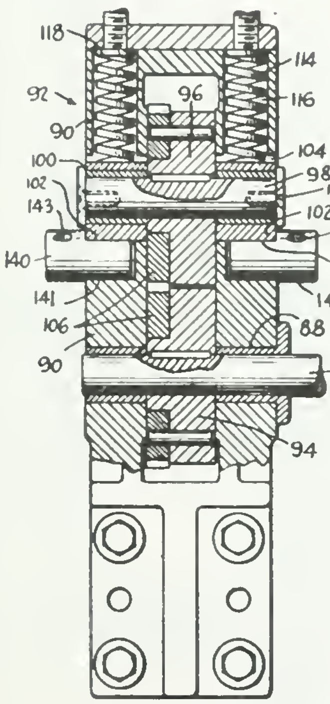

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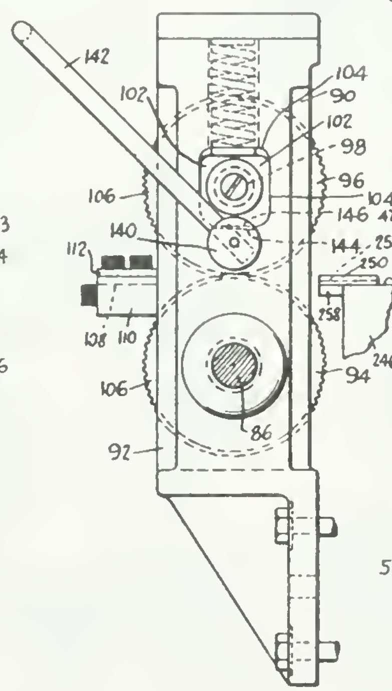

Fig. 12.

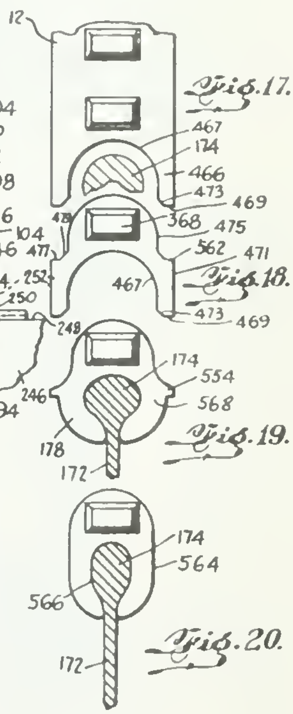

Fig. 20a.

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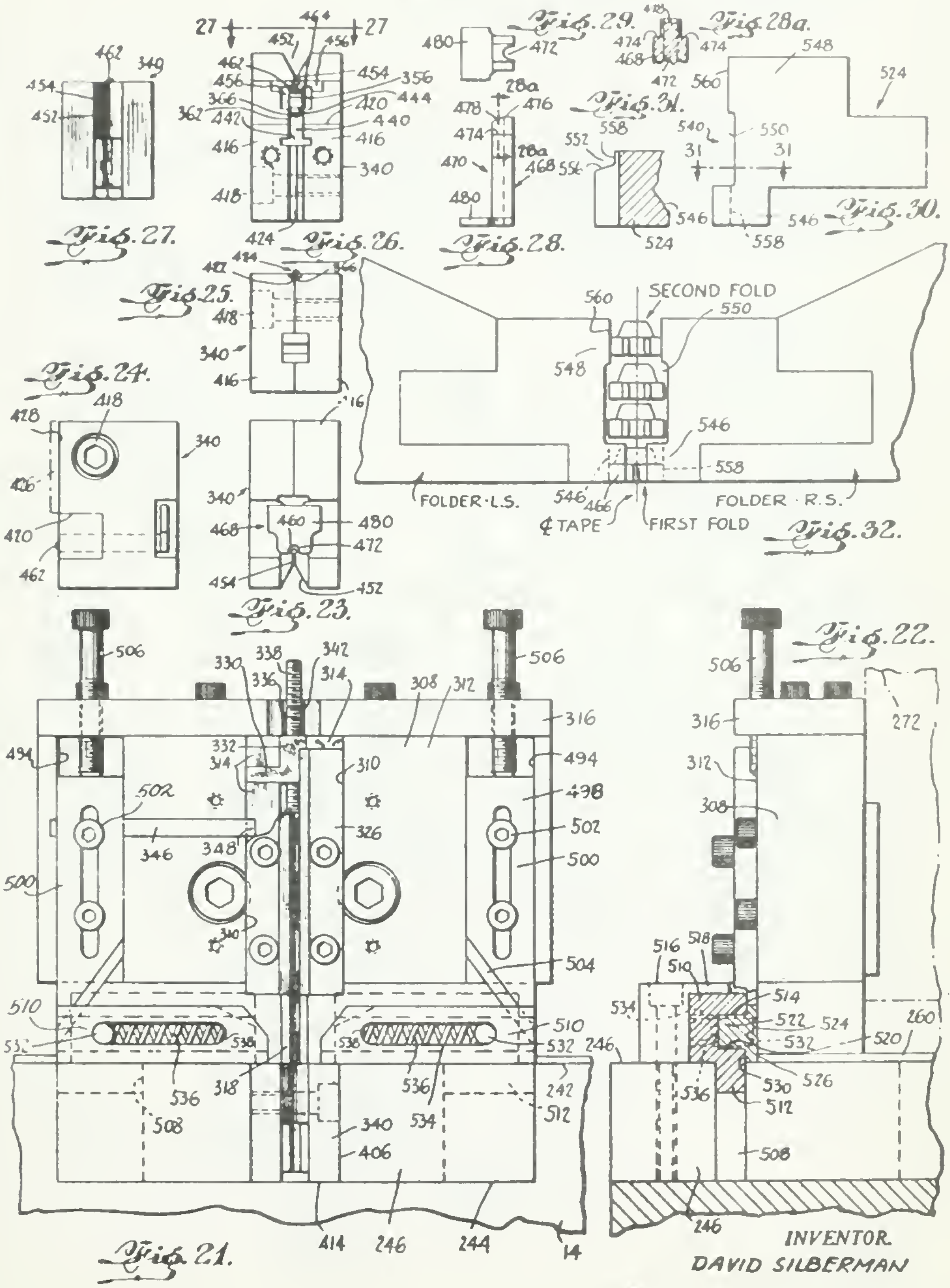

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ZIPPER MANUFACTURING MACHINERY

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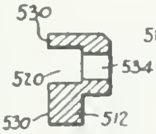


Fig. 38.

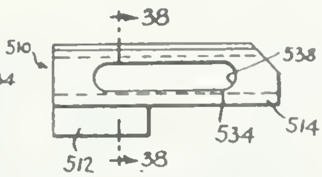


Fig. 37.

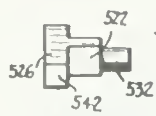


Fig. 40.

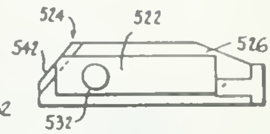


Fig. 39.

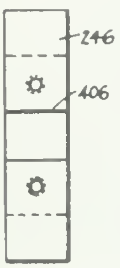


Fig. 36.

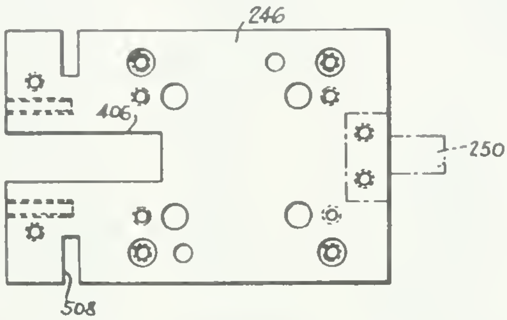


Fig. 35.

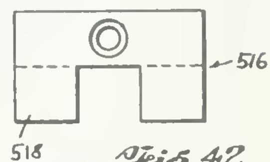


Fig. 42.

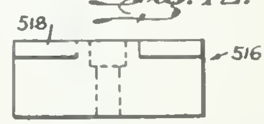
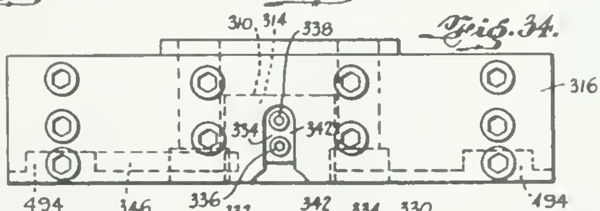


Fig. 41.

Fig. 34.



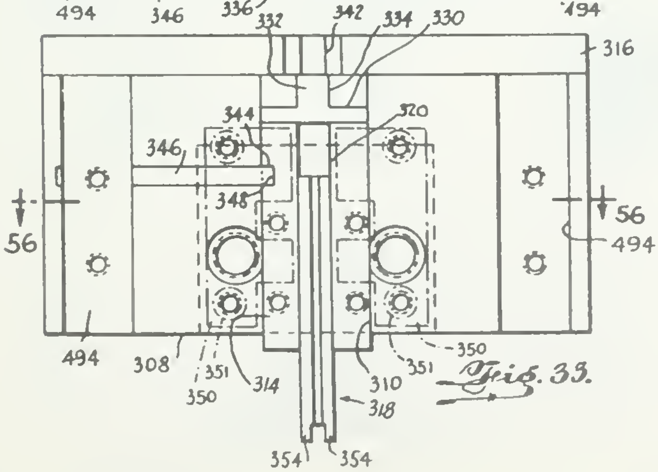
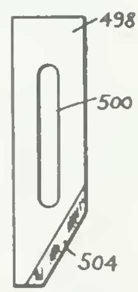


Fig. 33.



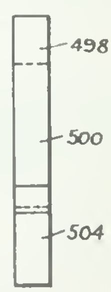


Fig. 43. Fig. 44.

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ZIPPER MANUFACTURING MACHINERY

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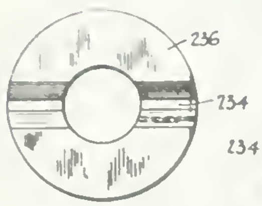


Fig. 45.

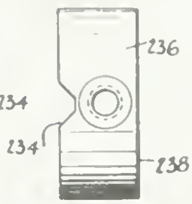


Fig. 46.

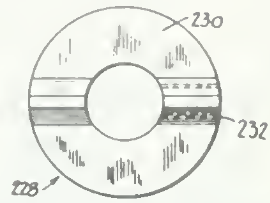


Fig. 47.

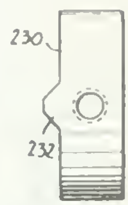
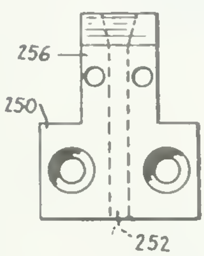


Fig. 48.



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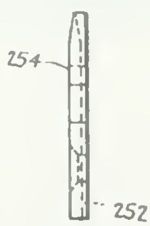


Fig. 50.

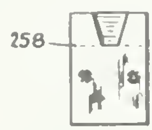


Fig. 51.

Fig. 52.

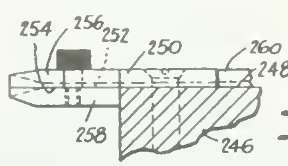


Fig. 53.

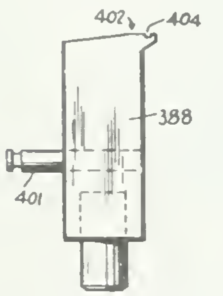
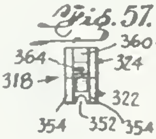


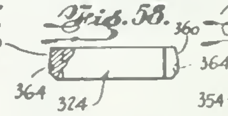
Fig. 55.

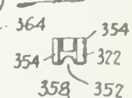
Fig. 54.

Fig. 58a

Fig. 57. Fig. 58. Fig. 59.







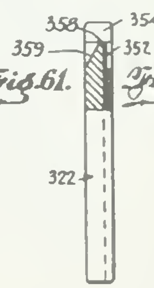


Fig. 61.

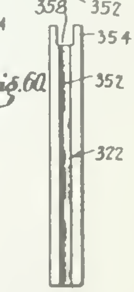


Fig. 60.

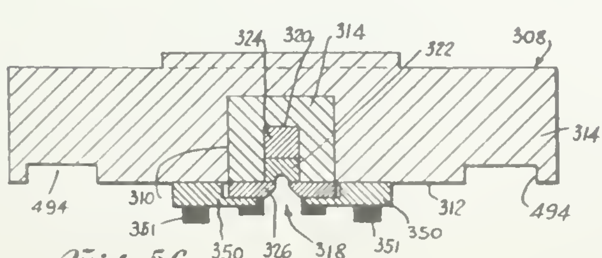


Fig. 56.

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March 16, 1948. D. SILBERMAN 2,437,793

ZIPPER MANUFACTURING MACHINERY

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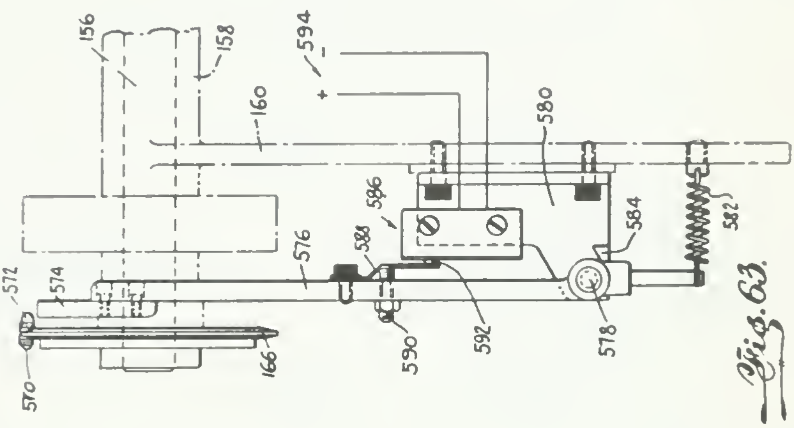

Fig. 63.

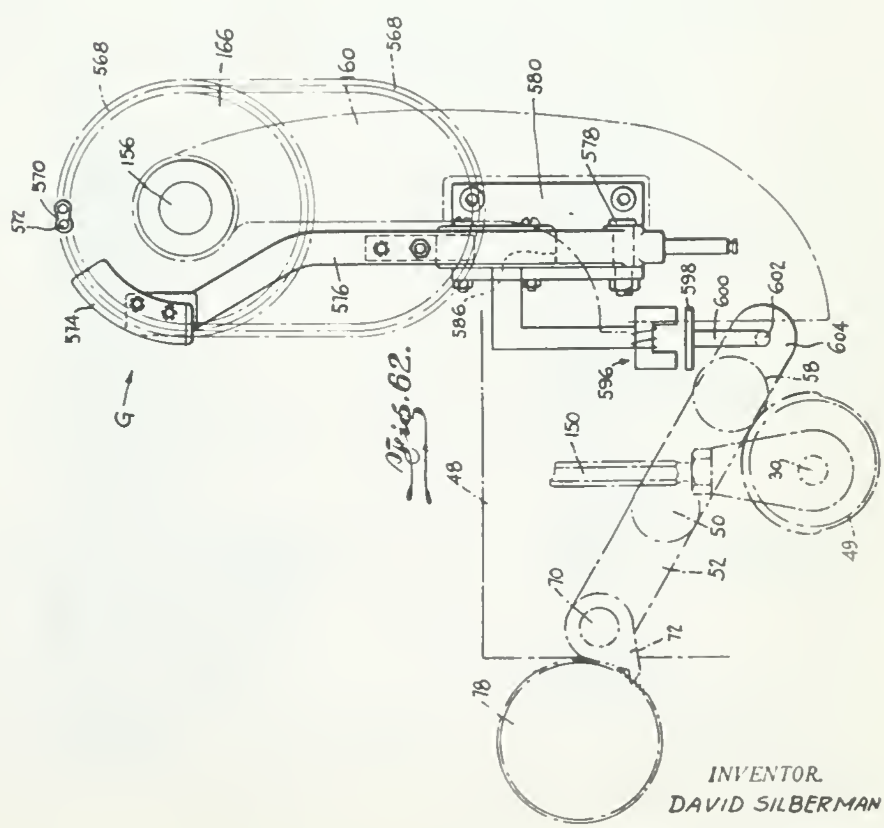

Fig. 62.

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ZIPPER MANUFACTURING MACHINERY

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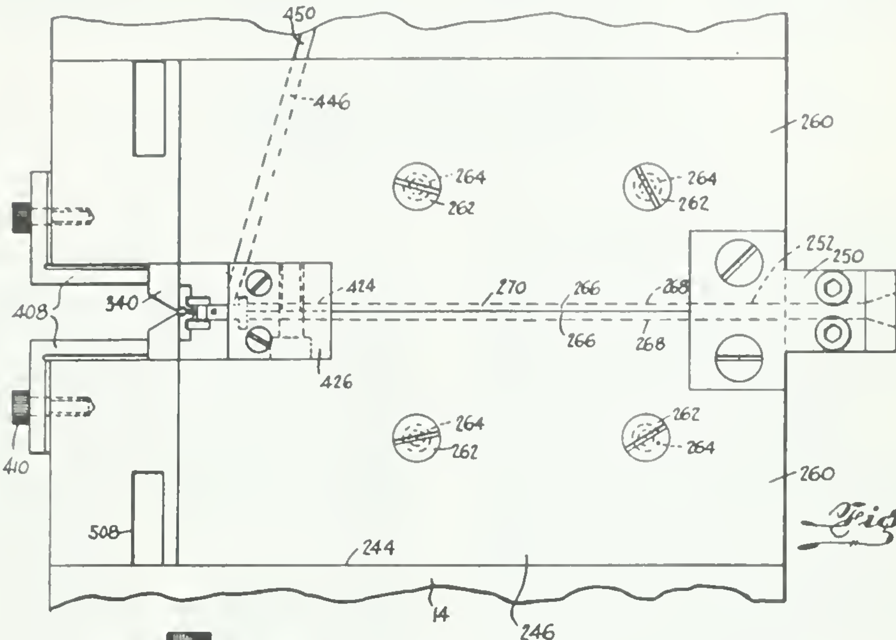

Fig. 65.

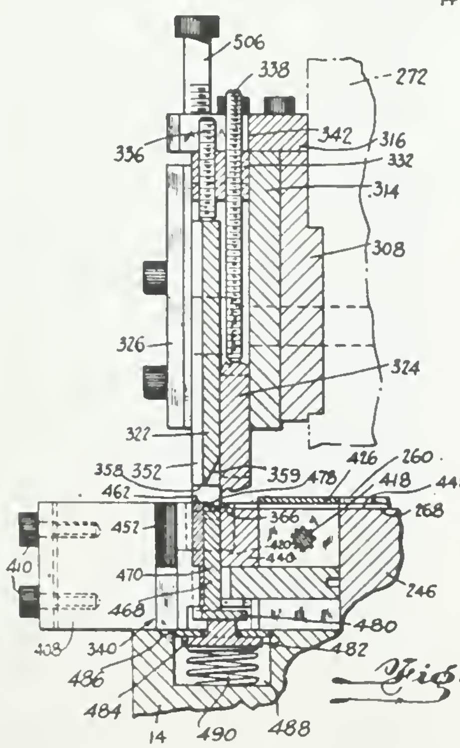

Fig. 64.

Fig. 66.

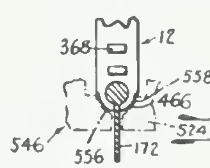

Fig. 67.

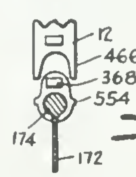

Fig. 68.

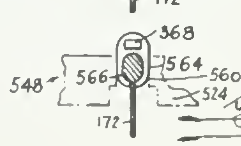

Fig. 69.

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UNITED STATES PATENT OFFICE

2,437,793

ZIPPER MANUFACTURING MACHINERY

David Silberman, New York, N. Y.

Application September 23, 1944, Serial No. 555,572

40 Claims. (Cl. 153—1)

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This invention relates to zipper manufacturing nachinery.

In the manufacture of zippers, one of the internediate products generally is a stringer, a length of material which may take the form of a tape, ipon an edge of which are disposed a plurality of members to which reference may sometimes oe made herein as "zipper elements." In the nanufacture of stringers, vital advances have oeen consummated by changes in the manufacturing process, where such changes result in large advantages in operation, and in the value of the product, both from the monetary and the mechanical standpoints.

One result sought under all circumstances is a stringer, the elements of which lock together irmly, and do not tend to separate on lateral stress. Also, it is desired that a formation be produced by the closed elements of the stringer o permit speedy and solid engagement by the slider, the member which cams the elements into and out of engagement with each other, and to permit use of a simple slider structure.

Another result that is sought is a simple machine, taking a strip of metal at one point, and a tape at another point, and delivering a completed stringer from some third point. It is desired that the simplicity of such a machine should oe such that little or no supervision, and little or no repairs, be required for its operation. One great point in the cost of production of an article such as a zipper is the amount of time during which the machine is shut down for repairs, and s non-productive. Reduction of the amount of ime during which it will be required to shut such a machine down for the replacement of worn out parts, aside from repairs from breakdowns, decreases the cost of the zipper produced by the nachine.

It is an object of the invention so to simplify he operation of a zipper manufacturing machine hat no particular mechanical skill will be requisite for repair or replacement of parts.

These machines have rapidly moving parts, ntroducing the factor of vibration, which, among other things, reduces the life of the machine. It is an object of the invention to construct a nachine of this type so that vibration is reduced o a minimum.

The machine to be described takes a simple strip of metal, and forms and separates a zipper element from the strip, and attaches that element o a tape. The machine is designed to carry on his operation at such great speed that a continuous tape, with elements attached to its edge, seems to feed from the machine. A single reciprocating part forms, cuts and attaches elements to the tape during each reciprocation. It is an object of the invention to locate the parts of the machine so that substantially all power delivering parts will be aligned in such manner with the main shaft that substantially little, if any, off-center power delivery will occur, and so that power delivery will be substantially vertically towards the base of the machine.

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The resultant reduction in side sway during the operation of the machine limits vibration almost exclusively to that arising from the vertical impact of the punch upon the metal strip. Since substantially all the power-delivering parts of the machine, moving in the one direction at the time of impact, are thus balanced in great degree, the forces, which normally tend, during operation, to produce extreme vibration in a machine of this character, are eliminated.

In the production of zipper stringers, scrap is a problem of great importance. There is the monetary saving from elimination of metallic loss. Many of the so-called scrapless machines are incorrectly named; in substantially all cases, scrap of some kind is involved. It has been ascertained that, in cases where elements were specified, yet no method of production was ascertainable for producing the elements specified. One case deals with the production of zipper elements by actual incision through the metal, and dividing the metal by a mechanical spreader. Such method, for wire of very small dimensions, is impractical. A spreader punch for such purposes would destroy, rather than make an incision in, the metal.

It is an object of the invention to manufacture zipper stringers by making a zipper element and attaching it to a tape as a part of a continuous operation, while a strip of metal is formed into the elements, and the elements are attached to the tape as a part of a continuous operation, where no scrap of any kind is produced, where all metal from the metallic strip is utilized in the production of the element, and where no incision is produced in the strip for the production of such elements.

The scrap produced by so-called scrapless machines has an important bearing upon efficient operation. The product is a very fine, jewel-like element. Therefore, the scrap produced in making such elements is of a very minute character. Such scrap tends positively to adhere to the moving parts of the machine, no matter how the designer intends to discharge it from the apparatus. These moving parts, which produce the element, are small. Because of their small dimensions, they are susceptible to injury from unpredictable impacts derived from such minute pieces of scrap. Since the parts move at great speed, the elimination of such scrap must be solved; otherwise, the machine is subject to various periods of shutdown while parts broken or injured because of such scrap are being replaced or repaired.

It is an object of the invention to eliminate scrap entirely from the production of zipper elements and their attachment to tape for the production of zipper stringers.

It is an object of the invention to provide a press wherein the apparatus need not be knocked down for repair or replacement of punch or die parts.

Other objects of this invention will be set forth hereinafter, or will be apparent from the description and the drawings, in which are illustrated embodiments of apparatus, process and product exemplifying the invention.

The invention, however, is not intended to be restricted to any particular construction or product, or any particular arrangement of parts, or any particular application of such construction or arrangement of parts, or any specific method of operation, or any of various details thereof, even where specifically shown and described herein, as the same may be modified in various particulars, or may be applied in many varied relations, without departing from the spirit and scope of the claimed invention, practical constructions embodying certain details of the invention being illustrated and described, but only for the purpose of complying with the requirements of the statutes for the disclosure of operative embodiments, but without attempting to disclose all of the various forms and modifications in which the invention might be embodied.

On the drawings, in which the same reference characters refer to the same parts throughout, and in which are disclosed such practical constructions,

Fig. 1 is a side elevational view of apparatus embodying features of the invention, the base, the frame and the reel of wire being broken away, and a part of an oil container being broken away to disclose other parts of the mechanism;

Fig. 1*a* is a plan view of a portion of a stringer produced by apparatus such as shown in Fig. 1;

Fig. 2 is an elevational view of the apparatus shown in Fig. 1, seen as looking at the apparatus from the right hand side in Fig. 1, the frame, the reel of wire, the wire itself and the part of the base being detached or removed, and the belt being broken away in section;

Fig. 3 is a detail elevational view, to enlarged scale, of parts of the wire feeding and tape feeding mechanisms, as seen in Fig. 1;

Fig. 4 is a side elevational view of a detail of the apparatus shown in Fig. 3, the connecting rod being broken away in section, and other parts of the apparatus not being shown, and the assembly of the cam and eccentric being broken away in section for clarity;

Fig. 5 is a detail front elevational view of the assembly of the ram, ram housing and crosshead with the base;

Fig. 6 is a plan view of the apparatus shown in Fig. 5, the base not being shown;

Fig. 7 is an elevational view, to enlarged scale, of the tape feeding and tensioning mechanisms as seen from the right hand side of Fig. 1, the ram housing and other details of the apparatus being broken away;

Fig. 7*a* is a view, to enlarged scale, of a portion of the tape feeding wheel, showing the manner of cooperation of the stringer with the wheel;

Fig. 8 is a side elevational view of a detail of the apparatus shown in Fig. 7, illustrating the bracket carrying the tape feeding means and the associated parts cooperating with the tape feeding wheel, the stringer being shown by dot-and-dash lines;

Fig. 9 is a vertical sectional view, to enlarged scale, taken substantially lengthwise of the main housing, parts of the base being broken away, and parts of the apparatus being removed, the ram housing and associated parts being shown in dot-and-dash lines, the flywheel and the pulley being broken away in section in part, and part of the main shaft and the connecting rods being broken away in section;

Fig. 10 is an elevational view of the connecting rod as assembled with its shaft and pin, as shown in Fig. 9, parts being broken away in section;

Fig. 11 is an elevational view, to enlarged scale, of the wire feeding assembly shown in Fig. 2, parts of the apparatus being broken away in section;

Fig. 12 is an end elevational view of the apparatus shown in Fig. 11, illustrating the association of wire guiding devices therewith and in relation to the base;

Fig. 13 is a detail view, in elevation, of a part of the braking mechanism for the wire feeding means, the shaft being shown in section, and the base being shown by dot-and-dash lines;

Fig. 14 is a front elevational view of the apparatus shown in Fig. 13;

Fig. 15 is a view, similar to Fig. 13, of the braking mechanism associated with the tape feeding mechanism;

Fig. 16 is a front elevational view of the apparatus shown in Fig. 15;

Fig. 17 is a plan view of a strip as it appears as its end is worked and cut by the element forming means, the strip being broken away, and a part of the tape being shown;

Fig. 18 is a plan view of an element which would be produced by such apparatus as here illustrated if the apparatus were operated without attaching the element directly to the tape;

Fig. 19 is a plan view of an element shown attached to a tape at an intermediate stage of the process of attaching the element to the tape, the tape being shown in section;

Fig. 20 is a plan view of an element attached to the tape after the final stage of attaching elements in accordance with the process, the tape being shown in section;

Fig. 20*a* is a vertical cross-sectional view of an element such as shown in Fig. 20, the tape not being shown;

Fig. 21 is a front elevational view of the base, die block, clamp blades and punch block assembly, the clamps for the die piece retaining block, for the clamp blade housings, and for the punch piece retaining member not being shown, and the means for fastening the punch block to the ram not being shown;

Fig. 22 is an end elevational view of the apparatus shown in Fig. 21, the base being broken away to show the die block, and the clamp blade housing, and the clamp blade being shown in section, the ram being shown by dot-and-dash lines;

Fig. 23 is a bottom plan view of a die block and associated parts embodying features of the invention;

Fig. 24 is a side elevational view of the block shown in Fig. 23, the stripper plate for the block being shown by dot-and-dash lines;

Fig. 25 is an end elevational view of the die block shown in Fig. 23;

Fig. 26 is a top plan view of the assembly of die block and strip returning member of Fig. 23;

Fig. 27 is a view of the die block as seen from the end indicated by line 27—27 of Fig. 26;

Fig. 28 is an elevational view of the strip returning member;

Fig. 28*a* is a detail vertical cross-sectional view of a portion of the strip returning member, as seen from the line 28*a*—28*a* of Fig. 28;

Fig. 29 is a plan view of the member shown in Fig. 28;

Fig. 30 is an elevational view of the clamp blade or folder for closing the elements upon the tape;

Fig. 31 is a detail cross-sectional view of the clamp blade, as seen from the line 31—31 of Fig. 30;

Fig. 32 is an end elevational view, to enlarged scale and broken away, showing the operation of the folder or clamp members;

Fig. 33 is an elevational view of the punch block, showing the removable punch retaining member and the punch assembled therewith, the clamps for the punch retaining member being shown by dot-and-dash lines;

Fig. 34 is a plan view of the punch block shown in Fig. 33, the punch retaining member being shown in position;

Fig. 35 is a plan view of the die block, the position of one of the wire guides being shown by dot-and-dash lines;

Fig. 36 is an end elevational view of the block shown in Fig. 35, as seen from the left hand end of Fig. 35;

Fig. 37 is an elevational view of a clamp blade housing;

Fig. 38 is a transverse cross-sectional view, on the line 38—38 of Fig. 37;

Fig. 39 is an elevational view of a clamp blade or folder member for cooperation with the housing shown in Fig. 37;

Fig. 40 is an end elevational view of the clamp blade shown in Fig. 39, as seen from the left hand end of Fig. 39;

Fig. 41 is an elevational view of a lock for the clamp blade housing;

Fig. 42 is a plan view of the lock shown in Fig. 41;

Fig. 43 is an elevational view of a cam member for assembly with the punch block for operating the clamp blade or folder;

Fig. 44 is an end elevational view of the cam member shown in Fig. 43;

Fig. 45 is a plan view of a cam member for release of the tape feeding mechanism;

Fig. 46 is an end elevational view of the member shown in Fig. 45;

Fig. 47 is a plan view of the member for cooperation with the cam member shown in Fig. 45;

Fig. 48 is an end elevational view of the member shown in Fig. 47;

Fig. 49 is a plan view of a part of the wire guiding means;

Fig. 50 is an end elevational view of the part shown in Fig. 49;

Fig. 51 is a plan view of a part cooperating with the part shown in Fig. 49;

Fig. 52 is an end elevational view of the part shown in Fig. 51;

Fig. 53 is a detail assembly view, showing the association with the base of the apparatus of the parts of Figs. 49 to 52;

Fig. 54 is a plan view of a detail of the tape tensioning mechanism;

Fig. 55 is a side elevational view of the device shown in Fig. 54;

Fig. 56 is a view in transverse cross-section, on the line 56—56, of the assembly of punch block, punch retaining member and punch, shown in Fig. 33;

Fig. 57 is a bottom plan view of the two sections of the punch, as assembled;

Fig. 58 is an elevational view of one of the sections of the punch shown in Fig. 57, one end of the section being broken away in cross-section;

Fig. 58*a* is a plan view of the punch section shown in Fig. 58;

Fig. 59 is an end elevational view of one of the sections of the punch shown in Fig. 57;

Fig. 60 is an elevational view of the punch section shown in Fig. 59;

Fig. 61 is a side elevational view of the punch section shown in Fig. 60, part of the punch being broken away in cross-section;

Fig. 62 is a detail view of modified construction for the tape and wire feeding means, associated parts of the apparatus being shown by dot-and-dash lines, and the parts of the apparatus for producing a gap in the stringer being illustrated by full lines;

Fig. 63 is an end elevational view of the apparatus shown in Fig. 62;

Fig. 64 is a detail vertical cross-sectional view, illustrating the association of the punch block, the punch retaining member, and the punch, with the base, the die block, the die piece retaining member, and the different portions of the die, together with the ram;

Fig. 65 is a plan view of a portion of the base, showing the relationship of the die block, the die piece retaining member, the clamps therefor, the stripper plates and the associated elements of the apparatus; and

Figs. 66, 67, 68 and 69 are detail views, illustrating the feeding and forming of the strip in relation to the tape edge, the tape being shown in cross-section.

Machine M (Figs. 1 and 2), illustrated upon the drawings, for the manufacture of stringers 10 (Fig. 1*a*), may include a mounting such as base B upon which a housing H may be mounted. Extending from base B may be a frame F for supporting a reel R of wire 12 which is guided to the apparatus in the manner to be described, for the production of the stringers.

In conjunction with housing H may be located substantially all mechanism necessary for the production of zipper stringers 10 from wire 12. Such mechanism may include wire feeding means W, tape feeding means T, and element forming and attaching means E. Housing H may take the form of a hollow casting 14, which may be retained upon base B in any suitable manner. The cavity 16 (Fig. 9) of casting 14 may provide a container for lubricating oil. For this purpose, a sight glass 18 (Fig. 1) may be connected with cavity 16 to indicate the level of oil retained therein.

In the instance shown, base B may include a plurality of legs 20. A platform (not shown) may be carried between legs 20 to support a motor (not shown), fixed to the platform by any suitable means. Power is delivered by the motor through a belt 26 to a pulley 28 upon a main shaft 30 which extends through side wall 32 of casting 14 at that position A flywheel 34 may be formed together with pulley 28.

Bearing members 36 for shaft 30 may be positioned at a pair of aligned openings 38 in side walls 32 and 40. Shaft 30 extends beyond the outer face of wall 40, where a cam 42 and an adjustable eccentric 44 are mounted. Cam 42 (Figs. 3 and 4) includes a collar 43 secured to the end of shaft 30 extending beyond wall 40. Collar 43 is formed with a slot 45 opening from an undercut transverse squared recess 47. On collar 43 is carried a cam ring 49 which is fixed to collar 43 against rotation by any suitable means. A pin 51 extends through and is slidable in slot 45 and has a squared head 53 received in recess 47. A collar 55 carried upon pin 51 serves as a bearing for adjustable eccentric 44. Suitable lock nuts 57 may be used to lock pin 51 and collar 55 in any adjusted position with relation to slot 45 and recess 47, to vary the eccentricity of eccentric 44. A guard cup 58 may be secured to face 48 of wall 40 to guard these parts.

By means of a plate 46, affixed to face 48, a pin 50 is positioned to function as a bearing for an arm 52. A cut-out 54 is formed in arm 52, and a pin 56 is extended across the opening of cut-out 54 and is fixed in the walls thus formed by the cut-out. A roller 58 is provided its bearing upon pin 56 so that it is in position to bear upon cam ring 48. A follower 60 is mounted to slide in a bore 62 under the action of a spring 66. The bore is formed in a boss 64, formed as a part of plate 46. The spring is retained between the end of the bore and follower 60, and causes arm 52 to retain roller 58 in engagement with ring 49. The pressure of spring 66 may be varied by means of a follower 68 which includes a screw-threaded adjustment at one end of bore 62 for that purpose.

One end of arm 52 is reduced in section, and retains a pin 70 which provides a bearing for the forked end of a finger 72. A spring 74, anchored at one end to an extension 76 from arm 52, engages finger 72 and maintains the finger in engagement with a ratchet wheel 78 for wire feeding means W. Carried in a bracket 80 upon wall 82 of casting 14 is a bearing 84 for a shaft 86 to which ratchet wheel 78 is affixed. Shaft 86 extends parallel to wall 82, and through a pair of bearings 88 (Figs. 2, 11 and 12) carried in the walls 90 of a housing 92. A knurled wheel 94, fixed to rotate with shaft 86, is retained between walls 90.

Above wheel 94, and retained between walls 90, is positioned another knurled wheel 96 affixed to a shaft 98. Shaft 98 is provided bearings 100 in a pair of square members 102 which are free to slide within a pair of openings 104. Openings 104 are formed in walls 90 above bearings 88. A pair of gears 106 are secured, or formed integrally with wheels 94 and 96. These gears mesh at substantially all times to drive both wheels simultaneously from shaft 86.

Wire 12 is inserted between wheels 94 and 96. First however, it must pass through a guide provided by a groove 108. Groove 108 is formed in the top face of a guide piece 110 affixed to housing 92 in advance of the position of knurled wheels 94 and 96. Groove 108 is aligned with the topmost level of wheel 94, and serves to guide wire 12 into proper relation to forming and attaching means E. A plate 112, affixed to the top face of guide piece 110, closes groove 108 and retains wire 12 within the groove during the feeding action.

Springs 114, retained in recesses 116 formed in walls 90, bear against the top faces of members 102. The extent of openings 104 permits movement of members 102 so that knurled wheels 94 and 96 will be spaced apart sufficiently, positively to engage wire 12 of the thickness necessary for proper operation of the apparatus. At the same time, movement of members 102 will not interfere with proper engagement of gears 106 for driving the knurled wheels. Proper compressor members 118 are threadedly adjustable relatively to recesses 116 for varrying the pressure upon members 102.

A bracket 120 (Figs. 2, 13 and 14) may be provided on wall 82. Secured upon bracket 120 are ends 122 of a pair of straps 124 which have arcuate sections 128 positioned to encircle a collar 126 fixed to shaft 86. Straps 124 are so formed that at least one set of ends 122, even when secured to bracket 120, or opposed ends 130 will be spaced apart. A bolt 132 passed through ends 130 retains a spring 134 for providing the necessary resiliency as the straps press a braking piece 138 of leather or other suitable material into engagement with the outside face of collar 128. Thus, the action of the step-by-step motion rotating shaft 86 is restrained to movement substantially in one direction.

A pair of pins 140 are fitted into openings 141 in walls 90, and may be rotated by means of a handle 142. For this purpose, openings 143 are formed in pins 140; the ends of handle 142, a U-shaped member, are fitted into the openings, and then are secured in position by means such as set-screws. The pins have flat faces 144 to engage against bottom faces 146 of members 102. Upon movement of handle 142 to lowered position, members 102 are cammed upwardly, and, with them, shaft 98, and its associated knurled wheel 96 and gear. Thus, the feeding mechanism, embodied in the knurled wheels, may be forced apart for threading wire into the machine, or are forced positively into engagement with the wire to be fed by the machine.

Collar 55 of eccentric 44 on shaft 30 (Figs. 1 to 4) carries an eccentric strap 148, which, through a rod 150, transmits motion to an arm 152. Arm 152 has a hub 154 through which a shaft 156 extends loosely. Shaft 156 is carried in bearings 158 (Figs. 7 and 8) formed in a bracket 160 which is secured to face 162 of wall 164. A sprocket 166 may be secured at one end of shaft 156 beyond hub 154. Sprocket 166 may serve as a spacing collar for retaining the shaft in proper relation to bearings 158, and also for other purposes hereinafter to be described.

A tape feed wheel 168 may be secured at the other end of shaft 156, and, with sprocket 166, serves to retain the shaft against lateral movement. Wheel 168 may have a knurled face 170 (Fig. 2) upon which a tape 172 (Figs. 7a and 8) having a beaded edge 174 is positioned for feeding. The wheel is cut away at one edge of the knurled face to provide a groove or recess 176 in which portions of elements 178, affixed to bead 174, may be received.

Arm 152 has a pin 180 (Figs. 1 and 3) fixed thereto. Upon pin 180 a finger 182 is provided a pivotal bearing. A spring 184 engaged between finger 182 and arm 152 serves to maintain ratchet tooth 186 of finger 182 in engagement with the ratchet wheel 168, mounted on shaft 156 between hub 164 and one of bearings 158.

At a position between bearings 158, bracket 160 may be cut away (Figs. 7, 15 and 16). At that point, shaft 156 may have a collar 178 fixed to rotate therewith. A pair of straps 180 have their ends 182 fixed against a face 184 of bracket 160 so that arcuate portions 186 of the straps substantially encircle collar 178. A strip 200 of leather or similar frictional material may be retained by portions 186, in engagement with the face of collar 178 to apply braking action to shaft 156. Straps 180 may terminate in a pair of arms 202 through which a bolt 204 may be passed. A spring 206 retained between one arm 202 and suitable lock-nuts on bolt 204 produces adjustment and resiliency for the braking device. This braking device prevents reverse rotation of shaft 156 as tooth 166 moves reversely over wheel 168 after having rotated wheel 168 in the feeding direction.

In order to assure that the tape be fed positively, a brake shoe 208 (Figs. 1, 7 and 8) is resiliently pressed towards engagement with knurled face 170. Shoe 208 has a face 210 shaped to conform to the arcuate shaping of wheel 168; but face 210 is smooth. A rod 212, loosely pinned at 214 to shoe 208, is slidable through an opening 216 in a bracket arm 218. Arm 218 is secured to a bracket arm 220 extending upwardly from bracket 160. A spring 222 on rod 212 between arm 218 and shoe 208 causes the shoe to apply the desired pressure against the tape caught between faces 170 and 210.

A pin 224, fixed in rod 212 and engaged in a slot 226 in arm 218, prevents rotation of rod 212. A collar 228 (Figs. 8 and 45 to 48), affixed to the extending part of rod 212 beyond arm 218, has a face 230 including a cam projection 232. Projection 232 is formed to interlock with a recess 234 in a collar 236. Collar 236 is loose upon rod 212, and has a flat face 238 for abutment against arm 218, where it is held by the action of spring 222. A handle 240, secured to collar 236, provides means for rotating the collar upon rod 212, to move cam projection 232 to move out of recess 234. Thus rod 212 is moved against the action of spring 222 to release brake shoe 208 from engagement with wheel 168 whenever it is desired to adjust the tape upon the wheel, or to position a new length of tape.

Forming and attaching means E is constructed to permit easy and ready separation of an entire assembly, or for the separation of one or more units, so that repairs and replacements may be made easily without disturbing the rest of the apparatus. Top wall 242 (Figs. 7, 9, 21, 22, 35 and 36) of casting 14 is formed with a recess 244 for receiving a block 246. At the side of housing 92 adjacent block 246 (Figs. 12 and 53), wire 12 is fed towards the punch and die by wheels 94 and 98 immediately at the top face 248 of block 246. At this position, a plate 250 is secured to face 248, and has a groove 252 formed in its bottom face 254. Plate 250 extends towards wheels 94 and 98 away from block 246. Beneath extension 256 thus formed, a small plate 258 is secured in position to complete the groove 252. Grooves 108 and 252 are in alignment, and together serve to retain the wire properly for feeding.

Beyond plate 250, a pair of stripper plates 260 are secured in position on top face 248, and are capable of limited adjustment. Plates 260 are secured by screws 262 passing through openings 264 slightly larger than screws 262. In this manner, limited adjustment of the plate edges 266 relatively to each other is made possible. Each edge 266 has a step 268; these steps are juxtaposed when the plates are assembled, and form a groove 270, in alignment with grooves 108 and 252, for receiving the wire as it is fed by the wire feeding means up to the position of the punch and die.

Reciprocating vertically with relation to block 246 is a ram 272 (Fig. 22) carried by a crosshead 274 (Figs. 5, 6 and 9). Ram 272 is slidable in ways 276 which are secured in a housing 278. Ways 276 are in the form of separate gibs which, by suitable securing means, are anchored in position in opposed corners of housing 278. Ways 276 have V-shaped grooves 280 to receive the V-shaped sides 282 of ram 272. Housing 278 is of a width to extend across recess 244 so that its footing 284 may be secured, by suitable means, to the top wall 242 of casting 14.

Ram 272 is secured to crosshead 274 by suitable securing means. The ends of crosshead 274 are formed with enlarged sections 286 having recesses 288 into which bearing pins 290 are received. Pins 290 are formed with heads 292, and are, in turn, received through the straps 294 (Fig. 9) at the ends of connecting rods 296. Set screws 298 lock pins 290 in place and thus hold straps 294 in proper relation to rock upon the pins in reciprocating the ram. Connecting rods 296 extend down into casting 14 through openings 300 in top wall 242 to eccentric straps 302 (Figs. 9 and 10), forming part of the connecting rods, which are received upon eccentrics 304 on shaft 30. Cover plates 305 may be provided at openings 300 to guard against foreign matter entering the chamber. A suitable flexible washer 307 may be fitted around each rod 296 to accommodate itself to the slight movement of the rod in sealing opening 300.

As shown, there is a rod 296 at each end of crosshead 274. Balanced forces are thus delivered to crosshead 274. Furthermore, the eccentricities of eccentrics 44 and 304 are small, being sufficient to obtain the small stroke necessary for the operation of the respective parts. Since wire or strip of relatively small thickness is utilized in these operations, only a small effective stroke of the ram is necessary. Thus, it has been made possible to perform these operations without massive cranks, of great stroke, but by small eccentrics of very small stroke. Furthermore, the centers of pins 290 are substantially perpendicularly above the center line of shaft 30. In the same manner, eccentric 44, and rod 150 actuated by that eccentric are disposed substantially perpendicularly vertically from shaft 30. Thus, substantially no off-center thrust results during the operation of the machine. Substantially all forces delivered are in substantially a single plane, torque is minimized, and vibration reduced to a minimum. Ram 272 and rod 150 move up and down substantially simultaneously and almost to the same degree, and vibrate substantially in that single plane, which also is the plane for the center-line of flywheel 34 the tendency of which is to absorb any of the vibration produced by any very slight lateral vibration.

The main body 306 of ram 272 takes the shape of a block having V-shaped edges 282 (Figs. 5 and 6). To body 306 is secured a ram block 308 (Figs. 22 and 23). A recess 310 (Figs. 21, 33, 34 and 56) is provided centrally of the front face 312 of block cured on top of block 308 is a plate 316. Block 314 will be moved solidly up against the bottom face of plate 316 during the operation of the apparatus.

The manner in which punch block 314 is assembled with ram block 308, and the method of assembly and adjustment of punch 318 with relation to block 314, constitute means applicable to machinery such as here described for zipper manufacture as well as for general application for punch press operation. By the arrangement to be described, it is possible to change punches and dies without first taking apart substantially the entire apparatus.

Block 314 is formed with a recess 320. In this recess, punch 318 is snugly seated. In the instance illustrated, punch 318 (Figs. 56 to 61) is made up of two distinct sections 322 and 324. Section 324 is positioned at the bottom of recess 320, with section 322 abutting against it. Then a pair of clamp plates 328, anchored against face 312 of block 314, hold both sections against separation from block 314. Block 314 (Figs. 21, 33 and 34) is formed with a pair of slots 330 extending transversely of block 314 and opening into recess 320. In slots 330 and the upper portion of recess 320 is located a T-shaped end piece 332 of hardened metal. In leg 334 of piece 332 a pair of screws 338 and 338 are threadedly received, respectively to engage against ends of sections 322 and 324. These screws serve to determine the levels at which sections 322 and 324 cooperate with die block 340. A cut-out 342 is formed in plate 316 to make the ends of screws 338 and 338 accessible for adjustment.

The action of sections 322 and 324 against the work, together with such clamping action as is secured from clamp plates 328, serves to locate the punch vertically with relation to the ram. In addition, a slot 344 cut in a side face of block 314 may be brought into registry with a slot 348 in block 308 for the reception of a key 348. In this manner, blocks 308 and 314 are restrained against relative vertical movement. A pair of clamp plates 350 have flanges in engagement with clamp plates 328, and are themselves secured to block 308 by cap screws 351. Thus, block 314 is clamped securely in position; but, merely by releasing screws 351, the entire assembly of block 314 with both sections of punch 318 may be separated from ram block 308, and a new assembly substituted. Likewise, it is possible to adjust the position of sections 322 and 324 to a definite relationship to block 314, and, therefore, to their positions in relation to block 308 determined by the interlock of key 348 in slots 344 and 348, without first assembling these parts with the ram. In this manner, the time necessary for replacement of a punch for any reason is made of no consequence, and the necessity for taking the entire ram assembly apart for any such purpose is completely eliminated.

Sections 322 (Figs. 59 to 61) is cut away to form a groove 352. Then, at one end, further metal is ground away to leave a pair of guide pieces 354 extending from the section. These guide pieces are intended to interfit with a recess 356 (Figs. 26, 64 and 65) provided in die block 340 for guiding and locating the punch. Groove 352 is of the exact shape of edge 358, the cutting edge of the punch. Thus, as edge 358 wears away during the punching operation, section 322 may be ground away between guide pieces 354 to form a new edge for a substantial portion of the length of the punch. Relief for edge 358 is provided by grinding section 322 away as shown at 359.

Section 324 has a squared end 360 to fit into a recess 362 in die block 340. A recess 364 is formed in end 360, to cooperate with a pin or projection 366 in die block 340. The effective level of end 360 with relation to pin 366 is determined by the position of screw 338. End 360 does no cutting, but merely upsets metal to form head 368 and recess 370 of a zipper element 178 (Fig. 20a) in the manner to be described. Opposite ends of section 324 (Fig. 58) are formed substantially identically. Thus, when one end wears out, clamp plates 328 are released, the punch removed from recess 320, section 324 is reversed, and the other end used. Screw 338 adjusts section 324 into desired relation to section 322 for cooperation with projection 366. Section 322 must pass entirely through the thickness of the metal to shear an element from the strip; section 324 merely applies sufficient pressure to form projection 366 from the metal. Thus, different times of engagement for these two punch sections are requisite. This timing is effected by adjustment of screws 336 and 338.

In order to maintain tape 172 in proper tension as it feeds to means E under the pull of wheel 188, a tension device 372 (Fig. 7) is assembled on face 182 at a groove 374 cut in face 182. A pair of blocks 376 and 378 are secured in groove 374 by suitable means. Block 378 is of such dimensions that its top face is just below a flange 380 below recess 244. Block 376 consists of an end member 382 seated in groove 374. A plate 384 is mounted at the outside face of member 382; plate 384 and member 382 are secured together and to casting 14 by suitable securing means. Slidable in passage 386 formed between plate 384 and groove 374 is a block 388, loosely held in passage 386, but propelled by a spring 390 retained between a follower 392 and block 388. Follower 392 is carried by a screw-threaded member 398 engaged in a threaded opening 400 in member 382 for adjusting the pressure applied by block 388 against the bead of tape caught between the ends 402 of blocks 376 and 388. A finger 401 may extend from block 388 for engagement by an operator to release engagement of the block against a tape edge.

Ends 402 (Figs. 54 and 55) are substantial duplicates. Block 378 is secured in position with relation to groove 374 by suitable securing means; block 388 is slidable against the action of spring 390; the operation of ends 402 is thus the same as if the two ends were movable relatively to each other for the purpose of varying the distance between them in placing the desired tension upon the tape as it is fed to the tape feeding wheel. Both ends 402 are formed with semi-cylindrica grooves 404 for the reception of bead 174. Also a pair of flat faces are provided for engagement against the tape proper. By adjusting member 398, the frictional force against the tape will be increased or decreased and the proper tension obtained.

Block 240 has a recess 406 formed immediately below the position of punch 318 (Figs. 21, 35, 64 and 65). Die block 340 is located in recess 406 and is held in place in the recess by clamps 408 which, by suitable securing means such as screws 410, are located and held in place against the front face of block 240. In such case, clamps 408 engage against the front faces of block 340 and force it firmly into recess 406. Then block

340 rests upon a platform 414 formed in casting 14 for that purpose.

The die block is made up of substantially identical, opposite sections 416, held together tightly by any desired clamping means, as, for instance, by a through screw 418. The die block as thus constituted has a recess 420. A pair of shoulders 422 in the top faces of sections 416 immediately at the contacted faces form a groove 424 which is located to align with grooves 108, 252 and 270. A stripper plate 426 is secured on top face 428 of block 340 to close groove 424, plate 426 extending up to the edge of recess 420.

Recess 420 receives snugly assembled pieces of hardened metal and retains them tightly in their appropriate association for location in relation to punch 318. These pieces are keyed in such manner that, by tightening sections 416 by means of screw 418, the parts are rigidly and accurately located. One of these pieces is a T-shaped section 440 which is interfitted with a portion of the recess so that it is held against any movement. It has a face 442 at the same level as the bottom of groove 424. It terminates together with the shaping of other inset pieces to form recess 356 with which the guide pieces 354 cooperate. Just short of end 444 of face 442, raised projection 366 is formed. This projection cooperates with recess 394 so that, when the ram depresses them into cooperating relation, they produce upset recess 370 and head 368 in the wire.

Grooves 446 may be provided on bottom faces 448 of plates 260, and continue beneath plate 426. These grooves are directed so that air from an airline 450, which makes connection with the inlet to the passage formed by the grooves 446, will be delivered just at about the position where this upsetting operation is taking place. Air under compression for such operation may be supplied constantly to the machine throughout the operation, and will serve the purpose of cooling the upsetting punch section and projection 366 throughout the operation.

The front faces of sections 416 are formed so that, when mated, a V-shaped groove 452 is presented, and leads into a very narrow slot 454. This groove and slot, when the die block is properly assembled, are aligned to cooperate with the groove between ends 402. Held securely in recess 420 immediately at the end of slot 454, is die piece 456. A curved edge 458 formed on this piece provides cutting cooperation with edge 358. Die piece 456 likewise has a cylindrical groove 460 located immediately behind slot 454, to receive the bead of the tape during the operation of the apparatus, and to locate the bead positively with relation to wire being fed. A projection or pilot 462, having substantially the contour of projection 366, may be provided upon face 464 of piece 456. Pilot 462 serves to locate the wire end as the operation of forming and severing an element proceeds.

Face 464 is at a level above face 442. Thus, the cutting off of an element at edge 458, that is, the shearing of the metal, will have commenced and even be finished, before the formation of head 368 and recess 370 will have been commenced, effecting, among other things, reduction in the force required to be delivered by ram 272 and crosshead 274. Wire is fed up to the position of pin or projection 366. Between pin 366

in the wire. Then the wire, by successive steps, is fed to a position where its first recess registers with and seats upon pilot 462. When so located, the end of the wire will have taken the form shown in Figs. 17 and 66, where a preceding section will have been severed by the action of the punch and die at edges 358 and 458. Thus it will have a pair of jaws or legs 466 which, by the action of the feeding mechanism, will be caused to straddle bead 174 of the tape. The spacing between projection 366 and pilot 462 is merely sufficient to compensate for the thickness of metal required for sections 322 and 324. It has been found that the distance for forming three heads 368 is all that is required for this purpose. Possibly stronger metal for use in cutting tools will reduce this spacing.

As shown in Figs. 17 and 18, the shaping of section 322 at cutting edge 358 and of the cooperating cutting edge 458 is such that legs 466 will have a curved portion 467 and straight edge end portions 469 substantially perpendicular to the side edges 471 which are defined by the edges of strip 12. A small angular cut 473 may connect portions 467 and 469 to prevent breaking of the punches and dies. This, in turn, will produce a round edge 475 for the bead end of element 178 having straight cut faces 477, leading out to edges 471, with connecting angular corners 479.

To complete the formation of the element and its attachment to the tape, the punch descends, and edge 358 cooperates with edge 458. When edge 358 engages against the wire to shear it, the cut end of the wire must move downwardly, leaving the cut away element 178 upon the die face at pilot 462. When the punch recedes and separates from the die, the wire must move back to a proper level so that, at the next movement of feeding wheels 84 and 96, it may feed into position onto pilot 462. For that purpose, a wire return member 468 is provided to move vertically within recess 356. Member 468 is substantially of identically the same shape as the opening of recess 356, including the shaping of edge 458. Member 468 includes a column 470 having a groove 472 to fit around the portion of piece 456 whose shape produces edge 458. The column is cut away to form a pair of shoulders 474 which cooperate with walls of the recess in receiving guide pieces 354. The section of column 470 which protrudes beyond shoulders 474 includes a flat face 476 to coincide with face 464, and a bevelled face 478. The latter, when member 468 is at its uppermost position, provides a cam edge from the level of face 442 to the level of face 464.

As the punch is assembled, guide pieces 354 are engaged in recess 356 around column 470 just above shoulders 474. The wire will have been upset at a previous operation. The end, fed forward, is moved upward along face 478 until the end recess 370 coincides with pilot 462. The punch descends, cutting off an element between edges 358 and 458. However, the end of the wire is moving downwardly, and presses against face 476 to move member 468 downwardly. Then the punch recedes.

It is now necessary that member 468 return to its first position, with face 476 at the level of face 464. For this purpose, column 470 has a foot 480 at its lower end. A pin 482 having a head 484 is positioned to engage against foot 480. Pin 482 extends down through a member 486 and into a within cavity 488 bears against the enlarged head 484, and against the bottom of cavity 486, thus tending to move pin 482 and member 488 upwardly. Pin 482 is limited in its movement by the engagement of head 484 with member 486. Member 488 is screw threaded to engage the threads formed in the walls of cavity 480. In this manner, adjustment of the upward limit of movement of pin 482 and, therefore, of member 468, may be effected.

The cutting off operation may be completed before jaws 466 have been clamped upon the tape bead, or these operations may even be timed to be substantially simultaneous. It has been found desirable that the operation of clamping jaws 466 to the tape edge be completed substantially before the cutting off step proceeds. In this manner, when the legs of the element have been clamped upon the tape edge, there is no necessity for controlling that element by holding it by any part of the machine during the stages of cutting off, as the element remains firmly attached to the tape.

For this purpose, block 308 is provided with a pair of recesses 494 adjacent its side edges (Fig. 21). In each of these recesses is positioned a cam plate 498. Plate 498 has a slot 500 through which may extend suitable clamping screws 502 which engage through plate 498 into block 308. Plates 498 are thus adjustable relatively to block 308. At their lower ends, plates 498 are provided with hardened cam faces 504 (Figs. 43 and 44). At their top ends, screws 506, threaded through plate 318, bear against each of plates 498 to hold them in properly adjusted position.

A pair of openings 508 are formed in block 248 to cooperate with the side walls of recess 244. A clamp blade guide 510 is located with relation to each cam plate 498 by engagement of a lug 512 (Figs. 21, 22, 37 and 38) formed as a projection from the bottom of a clamp blade housing 514. Thus, housing 514 is restricted against movement relatively to block 248 and base 14. A lock 516 is seated upon block 248 with a pair of overhanging fingers 518 straddling housing 514. Suitable securing means fixes lock 516 to block 248 and retains housing 514 against separation from block 248.

Housing 514 has a groove 520 in which slides leg 522 of a clamp blade 524 (Figs. 39 and 40) part of which is of T-shaped cross-section. The cross-bar 526 of the blade is positioned between end faces 528 of stripper plates 260 and unrelieved wall portions 530 of housing 514 on either side of groove 520. A pin 532 extends laterally from the blade and into a slot 534. A spring 536 is seated in slot 534 between pin 532 and end face 538 of slot 534, and is retained in the passage formed between lock 516 and leg 522, to drive blade 524 to a normal position where the engaging portions 540 of the blades will be moved away from each other, the position where they would engage an element to clamp it upon the tape.

When the punch descends for the cut-off of the element, guide pieces 354 are positioned in recess 356. Edge 358 cooperates with edge 458 in effecting the cut-off. In the manner set forth, recess 364 cooperates with projection 366 to upset recess 370 and head 368 in the wire. Just before these operations are effected, however, cam ends 504 will engage cam ends 542 on clamp blades 524. This operation will serve to drive blades 524 towards each other and the extending legs 466 on the wire, driving those legs towards and clinching them around bead 174.

As shown in Figs. 30 to 32, ends 546 of clamp blades 524 have two clamping sections 548 and 548. Between them is a gap 550. As shown in Fig. 32, clamping sections 546 are positioned to engage legs 466 as they are still open around the tape bead, and preferably before the element has been separated from the wire. The shaping of sections 546 for this purpose is shown in Fig. 31.

A complex face 552 is provided for obtaining the first bend of the metal. This shaping may have to be changed in accordance with the resilience or softness of the metal. The particular faces being considered were designed in connection with a low resiliency steel strip or wire. In connection with metal such as brass or copper, the angularities will have to be revised in accordance with the response of the metal to the clamping action. In this particular case, only the portion of section 546 indicated by face 552 will engage legs 466. Face 552 bends the metal of the legs, particularly as shown in Figs. 19 and 67. At the same time, face 556 strikes the legs and makes a slight indentation in forcing the legs firmly home against the tape. Thus the final result of the action of section 546 is to leave a corner 554 as the leg is bent from its original cut shape. As portion 556 of face 552 is at an angle of about 15° to the perpendicular to the end face of blade 524, and as it engages against the ends of legs 466, very slow closing or bending of the member will result until that slowly bending leg is hit by portion 556.

The action of the blades, as depicted in Figs. 18, 19 and 32, at this stage serves to bend the jaws into the shape shown in Figs. 19 and 67, without substantial decrease of the cross-section of the metal across portion 556. Corner 554, the corner 562 of Fig. 18, is left protruding, as the element is cut out of the continuous, parallel edged wire or strip such as used in this operation, without any scrap. Face 560 of section 548 extends beyond portion 556. Thus its action is an additional driving or closing action in finally driving the legs home, and smashing or swedging the metal of corners 554 into the body of the legs. First, however, section 322 completes the cutting off of the element, and the result is as shown in Fig. 68.

In the further operation illustrated, the wire is fed one or more, preferably two, steps after sections 546 have functioned, so that elements 178 will not be worked upon by blades 524, as assured by gap 550. Then faces 560 strike the element at corners 554. The result is a condensation of the metal in corners 554 into substantially flat faces 564; but now the density of metal in legs 466 has been increased because of the additional metal. At the same time, the legs have been stretched lengthwise across the width of the tape. Opening 566, in Fig. 20, has been reduced in its extent, and legs 466 now tightly clamp the bead of the tape, and also are tightly clamped against the body of the tape. An element made in this manner serves to produce a slide fastener which is strong so that the elements may not be pulled off the tape, and yet provides the desired shape for efficient operation of a substantially standard slider over the fastener elements. Such elements permit facility in operating the slider around curved portions of a slide fastener.

It is sometimes desirable to form gaps in stringers 10 for proper assembly of sliders and stops for separation of slide fasteners of predetermined length. For this purpose, a gap mechanism G

(Figs. 62 and 63) may be associated with the apparatus. Sprocket 166, previously referred to, may form a part of such mechanism. Such sprocket may carry a chain 568. One of the links 570 of the chain may have a pin 572 extending laterally therefrom. The length of chain 568 is such that, at a definite position, determined by the rotation of shaft 156 necessary to feed a predetermined length of tape 172, pin 572 will engage against a cam plate 574. Where the machine is to be used for producing zippers of various predetermined lengths, chains 668 of various lengths may be positioned on sprocket 166. Where the machine is designed, in relation to ratchet wheel 188 and tape feed wheel 168, to feed a definite amount of tape for each revolution of shaft 156, and such length is the length of a zipper to be produced, pin 572 may be affixed directly to sprocket 166.

In any case, cam plate 574 is secured at the end of an arm 576 pivoted at 578 upon a bracket 580 secured to bracket 160. A spring 582 extends between an extension of arm 576 and bracket 580 to move cam plate 574 towards sprocket 166. A stop 584 of suitable design may be formed or secured to bracket 580 to limit arm 576 in its movement under the action of spring 582. When pin 572 engages plate 574, arm 576 is swung away from the sprocket and functions to close a switch 586.

Arm 576 carries a leaf spring 588 the position of which, by means of an adjusting screw 590, is adjustable relatively to arm 576 and a button 592 extending from switch 586. Thus, for the length of time cam plate 574 is engaged by pin 572, button 592 will be depressed to close a circuit through switch 686. The circuit, from a power source 594, includes an electromagnet 596 which may be mounted on wall 48 of casting 14. Armature 598 for the electromagnet may be retained suitably for movement towards the pole pieces of electromagnet 596. By a suitable connection 600, which may be a rod or other member pivotally or flexibly connected to armature 598 and a pin 602 carried upon an extension 604 from arm 52, the electromagnet, when energized, is made effective to rotate arm 52 about pin 50 and lift roller 58 off cam ring 49. Thus, feeding of strip 12 is interrupted. The feed of tape 172 proceeds as before. The ram continues to reciprocate; however, since no metal is being fed, no elements are formed, and none are clamped upon the tape. Gaps are thus produced at regular intervals.

Many other changes could be effected in the particular device and product designed, and in the method of operation set forth, and in specific details thereof, without substantially departing from the invention defined in the claims, the specific description being merely of operative embodiments capable of illustrating certain principles of the invention.

I claim:

1. Slide fastener stringer manufacturing apparatus including means for feeding a tape into a predetermined position, means for feeding a metallic member towards that position, and means immediately at that position for performing all operations upon the fed member to form slide fastener elements from the fed member and to attach the elements to the fed tape directly from the fed member, the feeding means including a base, a shaft carried by the base, a ram, and cooperating means carried wholly by the ram and and cutting elements from the member and attaching the elements to the tape.

2. Slide fastener stringer manufacturing apparatus including means for feeding a tape into a predetermined position, means for feeding a metallic member towards that position, and means immediately at that position for performing all operations upon the fed member to form slide fastener elements from the fed member and to attach the elements to the fed tape, the forming means including a base, a shaft carried by the base, a ram, a pair of eccentrics of small eccentricity spaced apart on the shaft, rods extending from the eccentrics to each side of the ram, and cooperating means carried by the ram and the base and actuated entirely by the ram for forming and cutting elements from the member and attaching the elements to the tape.

3. Slide fastener stringer manufacturing apparatus, including means for feeding a tape into a predetermined position, means for feeding a metallic member towards that position, and means immediately at that position for performing all operations upon the fed member to form slide fastener elements from the fed member and to attach the elements to the fed tape, the forming means including a base, a shaft carried by the base, a pair of eccentrics of small eccentricity spaced apart on the shaft, a ram, a pair of connecting rods carried by the eccentrics, the connecting rods extending substantially vertically from the eccentrics to each side of the ram and having slight lateral movement during reciprocation by the eccentrics, and cooperating means carried wholly by the ram and the base for forming and cutting elements from the member and attaching the elements to the tape.

4. Slide fastener stringer manufacturing apparatus, including means for feeding a tape into a predetermined position, means for feeding a metallic member towards that position, and means immediately at that position for performing all operations upon the fed member to form slide fastener elements from the fed member and to attach the elements to the fed tape, the forming means including a base, a shaft carried by the base, a plurality of eccentrics of small eccentricity spaced apart on the shaft, a ram, a pair of connecting rods extending from a pair of the eccentrics to each side of the ram for reciprocating the ram, a connecting rod extending from one of the eccentrics for driving the tape feeding means, all of the connecting rods extending substantially vertically from the respective eccentrics and having slight lateral movement during reciprocation by the eccentrics, and cooperating means carried wholly by the ram and the base for forming and cutting elements from the member and attaching the elements to the tape.

5. In punch press construction, a base having a recess formed therein, a die block fitted into said recess and retained therein, a ram retained for movement towards and away from the die block, a punch block fixed to the ram, the punch block having a recess formed therein, means to form a wall at one end of the recess, the die block having a recess immediately below the recess in the punch block, a punch-retaining member clampingly retained in the recess in the punch block to position punches retained thereby towards and away from the recess in the die block, and a die-piece-retaining member clampingly locked in the recess in the die block and

punches, the punch-retaining member and the die-piece-retaining member being separable from the press without disturbing the relation of the ram and the punch block or the relation of the ram to the base or the relation of the die block and the base.

6. In punch press construction, a base having a recess formed therein, a die block fitted in said recess and fixed with relation to the base, a ram supported for movement towards and away from the die block, a punch block fixed to the ram, the punch block having a recess formed and extending substantially vertically therein and opening at the front face of the block, means to form a wall at the top end of the recess, the die block having a recess immediately below the recess in the punch block and opening at the front face of the block, a punch-retaining member clampingly retained in the recess in the punch block to position punches retained thereby towards and away from the recess in the die block, and a die-piece-retaining member clampingly locked in the recess in the die block and having means for interrelation with said punches, the punch-retaining member and the die-piece-retaining member being separable from the press without disturbing the relation of the ram and the punch block or the relation of the ram to the base or the relation of the die block and the base.

7. In punch press construction, a base having a recess formed therein, a die block fitted in said recess and fixed with relation to the base, a ram supported for movement towards and away from the die block, a punch block fixed to the ram, the punch block having a recess formed and extending substantially vertically therein and opening at the front face of the block, means to form a wall at the top end of the recess, the die block having a recess immediately below the recess in the punch block and opening at the front face of the block, a punch-retaining member, the punch-retaining member being slid into position through the open front of the recess and being then clampingly retained in the recess in the punch block to position punches retained thereby towards and away from the recess in the die block, and a die-piece-retaining member clampingly locked in the recess in the die block and having means for interrelation with said punches, the punch-retaining member and the die-piece-retaining member being separable from the press without disturbing the relation of the ram and the punch block or the relation of the ram to the base or the relation of the die block and the base.

8. In punch press construction, a base having a recess formed therein, a die block fitted in said recess and fixed with relation to the base, a ram supported for movement towards and away from the die block, a punch block fixed to the ram, the punch block having a recess formed and extending substantially vertically therein and opening at the front face of the block, means to form a wall at the top end of the recess, the die block having a recess immediately below the recess in the punch block and opening at the front face of the block, a punch-retaining member clampingly retained in the recess in the punch block to position punches retained thereby towards and away from the recess in the die block, and a die-piece-retaining member, the die-piece-retaining member being slipped into position through the open end of the recess in the die block and being then clampingly locked in the recess in the die block, the die-piece-retaining means having means for interrelation with said punches, the punch-retaining member and the die-piece-retaining member being separable from the press without disturbing the relation of the ram and the punch block or the relation of the ram to the base or the relation of the die block and the base.

9. In punch press construction, a base, a shaft carried by and extending transversely of the base, a housing supported on and extending transversely of the base above and having a plane substantially common with a plane passing through the center-line of said shaft, a ram movable in the housing and relatively to the base, eccentrics carried by the shaft, a crosshead fixed to the ram, and means connecting the eccentrics to the ends of the crosshead for reciprocating the ram with relation to the base, the plane of reciprocation of the ram being substantially the common plane of the shaft and the crosshead, and the connecting means moving substantially in the common plane.

10. In punch press construction, a base comprising a hollow housing, a shaft extending through the housing and transversely of the base, a ram housing supported on and extending substantially vertically from the base, a crosshead, a ram carried by the crosshead and movable in the ram housing relatively to the base, and means extending through the housing from the shaft to the crosshead for reciprocating the ram in the ram housing with relation to the base.

11. In punch press construction, a base comprising a hollow housing, a shaft extending through the housing and transversely of the base, a ram housing supported on and extending substantially vertically from the base, a crosshead, a ram carried by the crosshead and movable in the ram housing relatively to the base, and means extending through the housing from the shaft to the crosshead for reciprocating the ram in the ram housing with relation to the base, the ram reciprocating vertically in a path directly vertically above the shaft.

12. In punch press construction, a base comprising a hollow housing, a shaft extending through the housing and transversely of the base, a ram housing supported on and extending substantially vertically from the base, a crosshead, a ram carried by the crosshead and movable in the ram housing relatively to the base, and means extending through the housing from the shaft to the crosshead for reciprocating the ram in the ram housing with relation to the base, the ram reciprocating vertically in a path directly vertically above the shaft and the reciprocating means extending substantially vertically from the shaft to the crosshead.

13. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram reciprocable towards and away from the base, means for feeding a substantially uniform metallic strip between the reciprocable ram and the base, means for feeding a tape past the end of the fed strip, the ram and the base having complementary means for forming and separating a slide fastener element from the fed strip, a pair of jaws on the base, the jaws being disposed on either side of the tape and being slidable towards each other for engaging and closing the element upon the edge of the tape, and cams carried by the ram, the cams and the jaws having cam faces brought into direct engagement on downward movement of the ram to drive the jaws into engagement with the element to close it upon the edge of the tape.

14. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform continuous metallic strip between the ram and the base, means for feeding a tape past the end of the fed strip, the ram and the base having complementary means for forming and separating a slide fastener element from the fed strip, a pair of jaws on the base, the jaws being disposed on either side of the tape and being slidable towards each other for engaging and closing the element upon the edge of the tape, and means on the ram for engaging the jaws to drive them into engagement with the element to close it upon the edge of the tape at the same time that the complementary means is forming and separating an element from the strip.

15. Apparatus for producing slide fastener stringers, including means for feeding a tape past an assembly position, means for positioning the legs of a slide fastener element astride the tape edge, a ram, the ram having means for engaging the element on movement of the ram in one direction, and clamping members actuated by the ram on movement in that direction for closing the legs of the element upon the tape edge.

16. Apparatus for producing slide fastener stringers, including means for feeding a tape past an assembly position, means for positioning the legs of a slide fastener element astride the tape edge, clamp blades movable toward and away from the tape, means on the blade for effecting a plurality of closing impacts with each leg to drive the leg into engagement with the tape edge, and means for driving the blades to impart closing impacts to the legs.

17. Apparatus for producing slide fastener stringers, including means for feeding a tape past an assembly position, means for positioning the legs of a slide fastener element astride the tape edge, clamp blades movable toward and away from the tape, means on the blade for effecting a plurality of closing impacts of different degree with each leg to drive the leg into engagement with the tape edge, and means for driving the blades to impart closing impacts to the legs.

18. Apparatus for producing slide fastener stringers, including means for feeding a tape past an assembly position, means for positioning the legs of a slide fastener element astride the tape edge, clamp blades movable toward and away from the tape, means on the blade for effecting a plurality of successive closing impacts of increasing force with each leg to drive the leg into engagement with the tape edge, and means for driving the blades to impart closing impacts to the legs.

19. Apparatus for producing slide fastener stringers, including means for feeding a tape past an assembly position, means for positioning the legs of a slide fastener element astride the tape edge, clamp blades movable toward and away from the tape, each blade having a plurality of faces for impacting a fastener leg, the faces being related so that progressively increasing impact will be delivered by a succeeding face to drive the leg into engagement with the tape edge, and means for driving the blades to impart closing impacts to the legs.

20. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, and means removably carried by the ram and the base for forming slide fastener elements from stock fed past the ram and for attaching the elements to tape fed past the ram, the forming means, the ram and the base being formed to permit the forming means to be removed from the association by movement transversely of the direction of said relative movement.

21. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, and means removably carried by the ram for forming slide fastener elements from stock fed past the ram, the forming means and the ram being formed to permit the forming means to be removed from the association by movement transversely of the direction of said relative movement.

22. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, and means for forming slide fastener elements from stock fed past the ram, the ram and the forming means being constructed for assembly of the forming means with and separation of the forming means from the ram, the forming means and the ram being formed to permit the assembly and separation by movement of the forming means into and out of association with the ram transversely of the direction of said relative movement.

23. Apparatus for slide fastener maufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, the ram having a recess opening transversely of the direction of said relative movement, and means removably positioned in the recess for forming slide fastener elements from stock fed past the ram, the forming means and the recess being formed to permit the assembly and separation of the forming means and the recess by movement of the forming means into and out of the recess transversely of the direction of said relative movement.

24. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, the ram having a recess opening from a side wall thereof, and means removably positioned in the recess for forming slide fastener elements from stock fed past the ram, the forming means and the recess being formed to permit the assembly and separation of the forming means and the recess by movement of the forming means into and out of the recess transversely of the direction of said relative movement.

25. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, the ram having a recess opening from a side wall thereof, a block seated in the recess and removably held against movement forwardly out of the recess, the block having a recess opening in the same direction as the ram recess, and means removably held in the block recess, said means comprising means for forming slide fastener elements from stock fed past the ram, the block and the ram recess being formed to permit the block and the forming means to be assembled as a unit with or with or to be separated as a unit from the ram recess transversely of the direction of said relative movement.

26. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, the ram having a recess opening from a side wall thereof, a block seated in the recess and removably held against movement forwardly out of the

recess, the block having a recess opening in the same direction as the ram recess, and a plurality of metal working members snugly seated in abutting relation in the block recess, the members being slidable with relation to each other and the block, the members comprising means for forming slide fastener elements from stock fed past the ram, the block and the ram recess being formed to permit the block and the members to be assembled as a unit with or to be separated as a unit from the ram recess transversely of the direction of said relative movement.

27. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, the ram having a recess opening from a side wall thereof, a block seated in the recess and removably held against movement forwardly out of the recess, the block having a recess opening in the same direction as the ram recess, and a plurality of metal working members snugly seated in abutting relation in the block recess, the members being slidable with relation to each other and the block, means carried by the block adjustably to fix the positions of the members with relation to the block, the members comprising means for forming slide fastener elements from stock fed past the ram, the block and the ram recess being formed to permit the block and the members to be assembled as a unit with or to be separated as a unit from the ram recess transversely of the direction of said relative movement.

28. Apparatus for slide fastener manufacture, comprising a ram, a base, means for effecting relative movement of the ram and the base, the ram having a recess opening from a side wall thereof, a block seated in the recess and removably held against movement forwardly out of the recess, the block having a recess opening in the same direction as the ram recess, and a plurality of metal working members snugly seated in abutting relation in the block recess, the members being slidable with relation to each other and the block, means carried by the block adjustably to fix the positions of the members with relation to the block and to each other, the members comprising means for forming slide fastener elements from stock fed past the ram, the block and the ram recess being formed to permit the block and the members to be assembled as a unit with or to be separated as a unit from the ram recess transversely of the direction of said relative movement.

29. In punch press construction, a base, a shaft, ways positioned on the base, a crosshead, eccentrics carried by the shaft, a ram carried by the crosshead and slidable in the ways, the crosshead being positioned free of and extending beyond the ways, and means connecting the eccentrics to the crosshead extensions for reciprocating the ram with relation to the base, the crosshead and the ram reciprocating in a plane substantially including the shaft, the connecting means moving substantially in said common plane.

30. In punch press construction, a base, a shaft, eccentrics carried by the shaft, ways positioned on the base, a crosshead disposed substantially vertically above the shaft, a ram carried by the crosshead and slidable in the ways, the crosshead being positioned free of and extending beyond the ways, and means connecting the eccentrics to the crosshead extensions for reciprocating the ram with relation to the base, the crosshead and the ram reciprocating in a plane substantially including the shaft, the connecting means moving substantially in said common plane.

31. In punch press construction, a base, a shaft, a ram movable relatively to the base, means actuated by the shaft for reciprocating the ram with relation to the base, a punch block carried by the ram, the block having a recess formed therein and extending substantially the entire extent of the block in the direction of movement of the ram, a punch holder seated snugly in the recess, the punch holder having a recess extending substantially the entire extent of the holder in the same direction as the recess in the block, and a punch nested in the punch holder recess.

32. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip to the ram, means for feeding a tape in a fixed path in the path of movement of the fed strip, means comprising means slidable on the base and engageable by means on the ram for closing elements on the edge of the tape, and means carried by the ram for forming an element in the strip and for separating an element from the strip, the closing means and the forming and separating means being made effective during the same stroke of the ram in one direction.

33. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip to the ram, means for feeding a tape adjacent the ram, means comprising means engageable by means on the ram for closing elements on the edge of the tape, and means for forming an element in the strip and for separating an element from the strip on movement of the ram in one direction, the closing means being energized by the ram during movement of the ram in said direction.

34. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip to the ram, means for feeding a tape adjacent the ram and in the path of movement of the fed strip, means comprising means engageable by means on the ram for closing elements on the edge of the tape, and means for forming an element in the strip and for separating an element from the strip on movement of the ram in one direction, the closing means being energized by the ram during movement of the ram in said direction.

35. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip to the ram, means for feeding a tape in the path of movement of the fed strip, means comprising means slidable on the base and engageable by means on the ram for closing elements on the edge of the tape, and means for forming an element in the strip and for separating an element from the strip on movement of the ram in one direction, the closing means being energized by the ram during movement of the ram in said direction.

36. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip to the ram, means for feeding a tape in the path of movement of the fed strip, means comprising means slidable on the base and engageable by

means on the ram for closing elements on the edge of the tape, and means carried by the ram for forming an element in the strip and for separating an element from the strip on movement of the ram in one direction, the closing means being energized by the ram during movement of the ram in said direction.

37. Slide fastener stringer manufacturing apparatus, including means for feeding a tape in a fixed path past a predetermined position, means for feeding a metallic member toward that position, and means immediately at that position for performing all operations upon the fed member to form slide fastener elements from the fed member and to attach the elements to the fed tape directly from the fed member, the forming means including a base, a ram, means for reciprocating the ram, and cooperating means carried by the ram and the base and actuated entirely by the ram for forming portions of elements in the member including legs at the end of the member, the feeding means moving the member to place the legs astride the fed tape, and the cooperating means comprising means for cutting an element from the member and for attaching the element to the tape as the legs of the element integrally formed in the member are extended astride the fed tape.

38. Slide fastener stringer manufacturing apparatus, including means for feeding a tape into a predetermined position, means for feeding a metallic member toward that position, and means immediately at that position for performing all operations upon the fed member to form slide fastener elements from the fed member and to attach the elements to the fed tape, the forming means including a base, a shaft, a ram, eccentrics of small eccentricity on the shaft, rods extending from the eccentrics to the ram, and cooperating means carried by the ram and the base and actuated entirely by the ram for forming portions including legs of elements in the member, the feeding means moving the member to place the legs astride the fed tape, and the cooperating means comprising means for cutting an element from the member and for attaching the element to the tape as the legs of the element are extended astride the fed tape.

39. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip between the ram and the base, means for feeding a tape in a fixed path past the end of the fed strip, the ram and the base having complementary means for forming and separating a slide fastener element from the fed strip, means slidable on the base immediately at the position of the separating means and disposed on either side of the tape for closing the element upon the edge of the tape as it is separated from the strip, and means on the ram for directly engaging the slidable means to drive them into engagement with the element to close it upon the edge of the tape.

40. In apparatus for forming slide fastener stringers, the apparatus including a base, a ram movable with relation to the base, means for feeding a substantially uniform metallic strip between the ram and the base, means for feeding a tape in a fixed path past the end of the fed strip, the ram and the base having complementary means for forming and separating a slide fastener element from the fed strip, a pair of jaws on the base immediately at the position of the separating means, the jaws being disposed on either side of the tape and being slidable toward each other for engaging and closing the element upon the edge of the tape as it is separated from the strip, and means on the ram for engaging the jaws to drive them into engagement with the element to close it upon the edge of the tape, the jaws and the jaw engaging means having cam faces for direct engagement.

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Certificate of Correction

Patent No. 2,437,793. March 16, 1948.

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It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 17, line 64, claim 1, and column 18, line 4, claim 2, after the syllable "ratus" insert a comma; column 22, line 67, claim 25, strike out the words "with or"; column 25, line 20, claim 37, for "partions" read *portions*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of May, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

PLAINTIFF'S EXHIBIT No. 13

G. Sundback Patent No. 1,467,015

Filed July 10, 1919 Patented Sept. 4, 1923

Sept. 4, 1923. 1,467,015

G. SUNDBACK

METHOD AND MACHINE FOR MAKING FASTENERS

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Fig: 1.

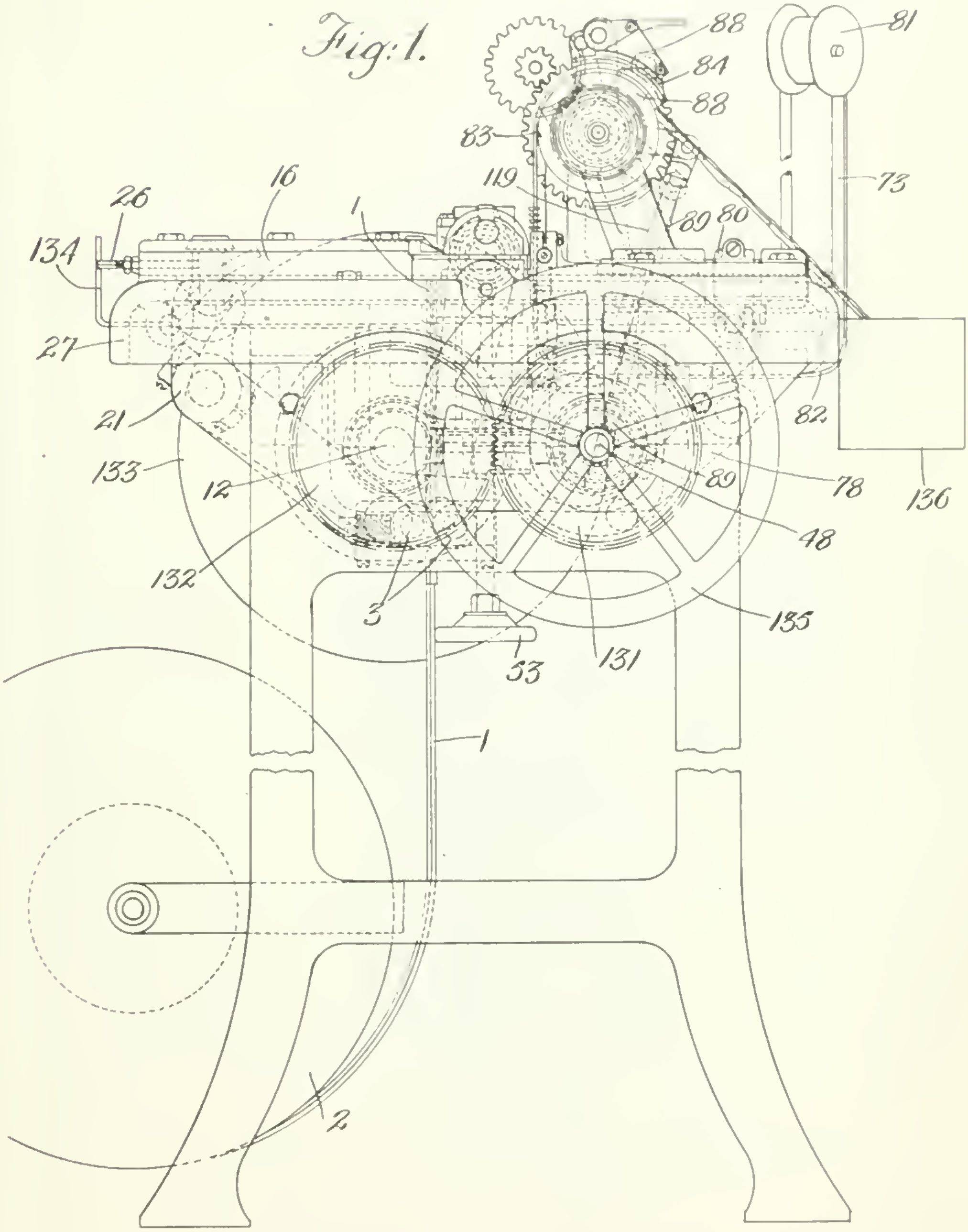

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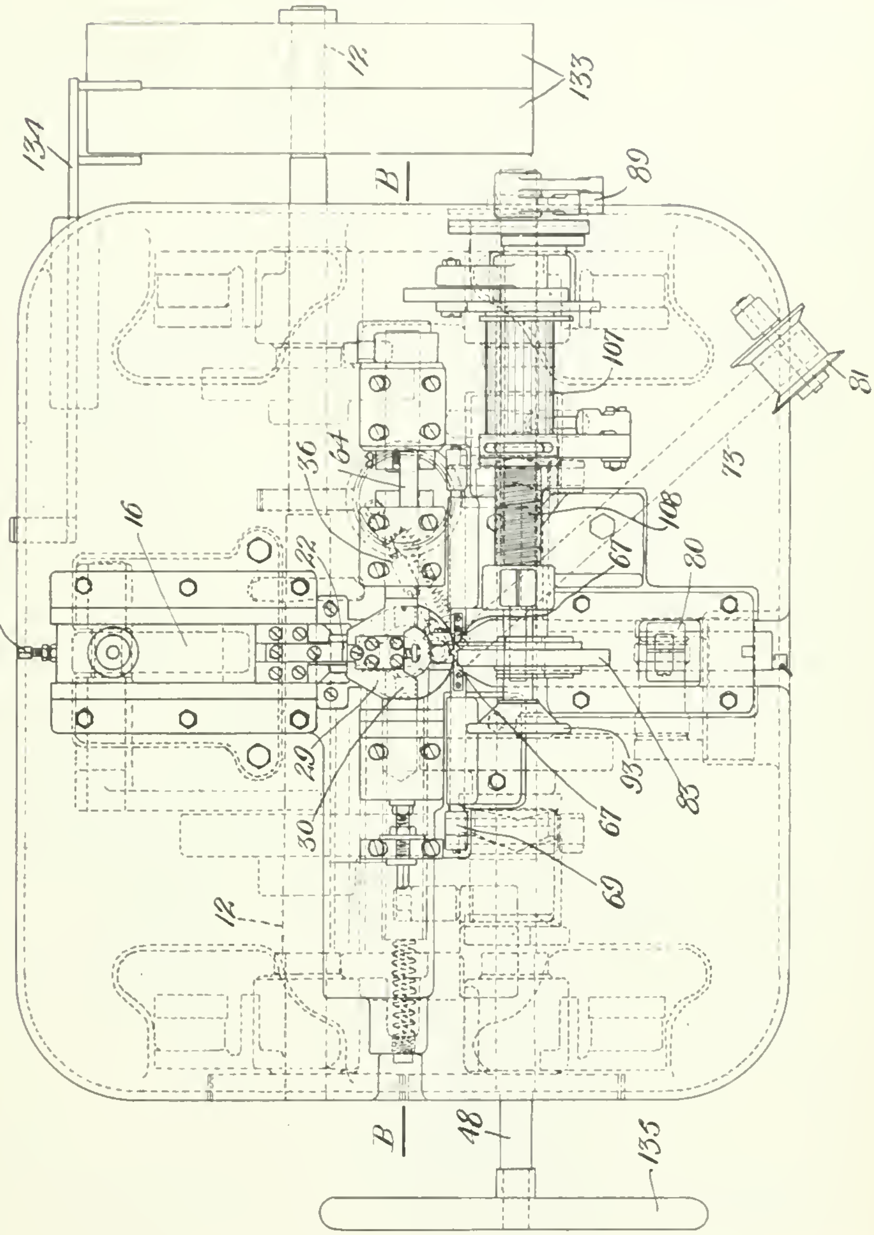
Fig. 2.



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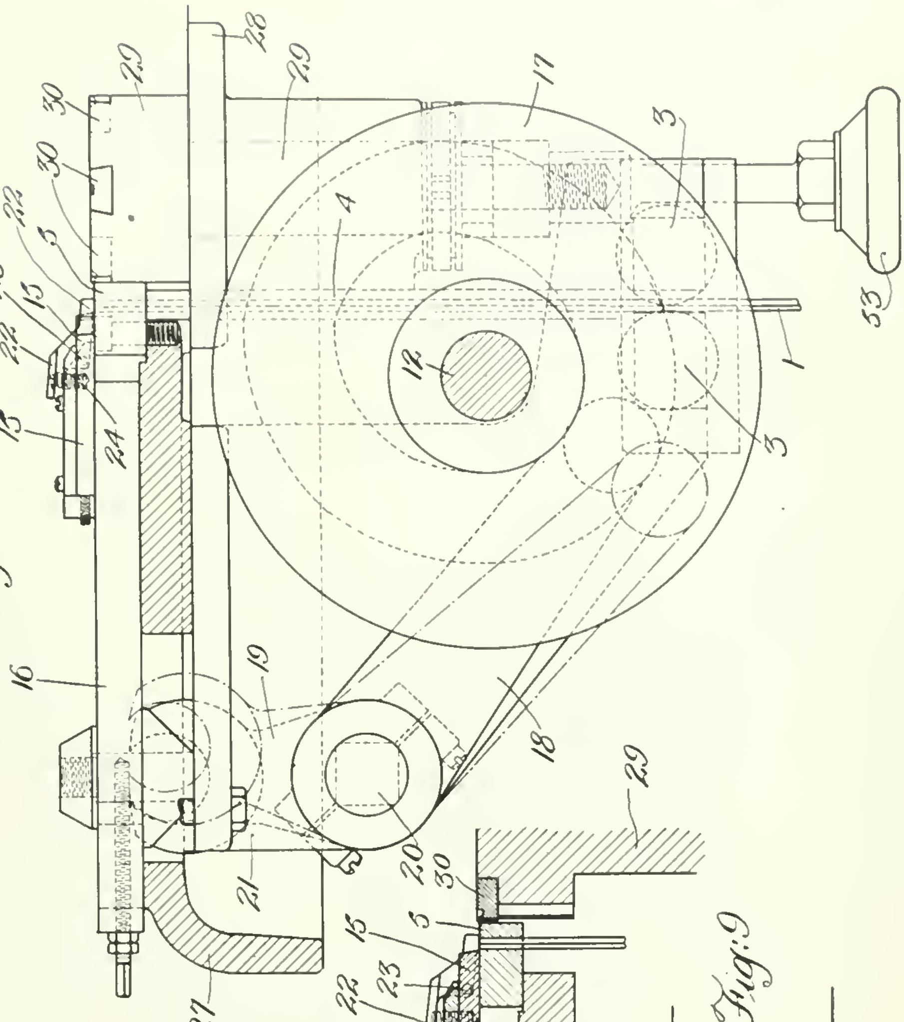

Fig. 3.

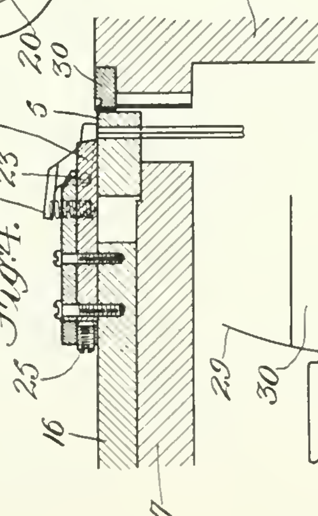

Fig. 4.

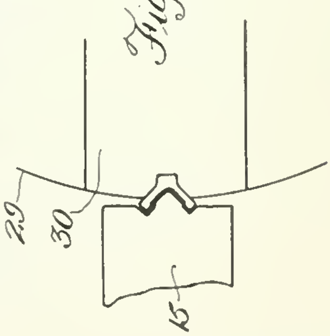

Fig. 9

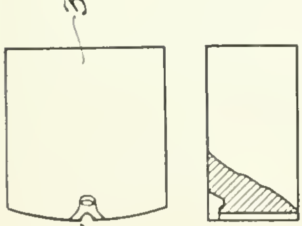

Fig. 23.

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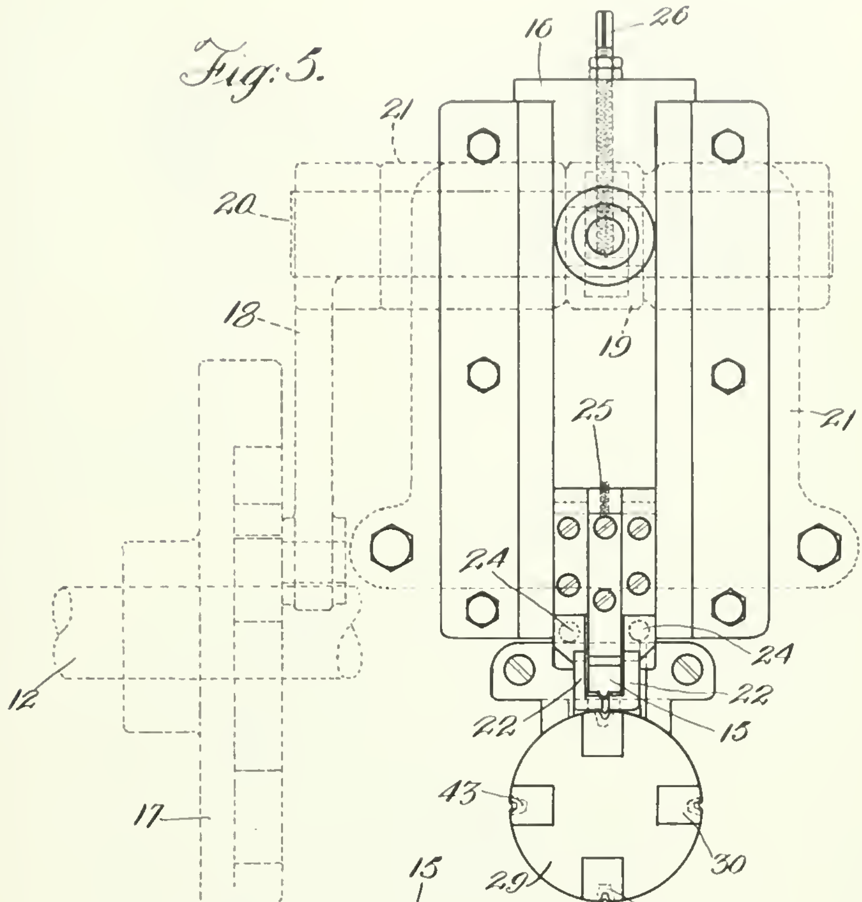
Fig:5.



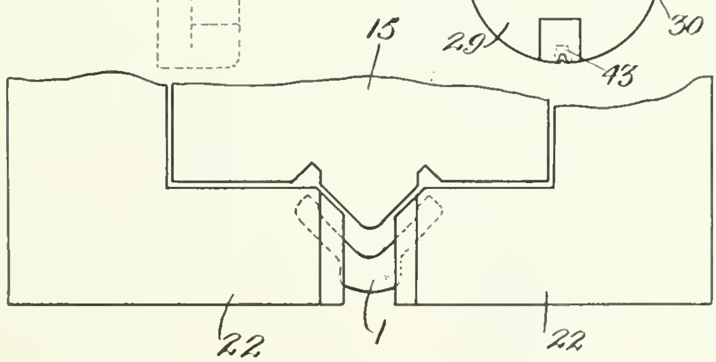


Fig:6.

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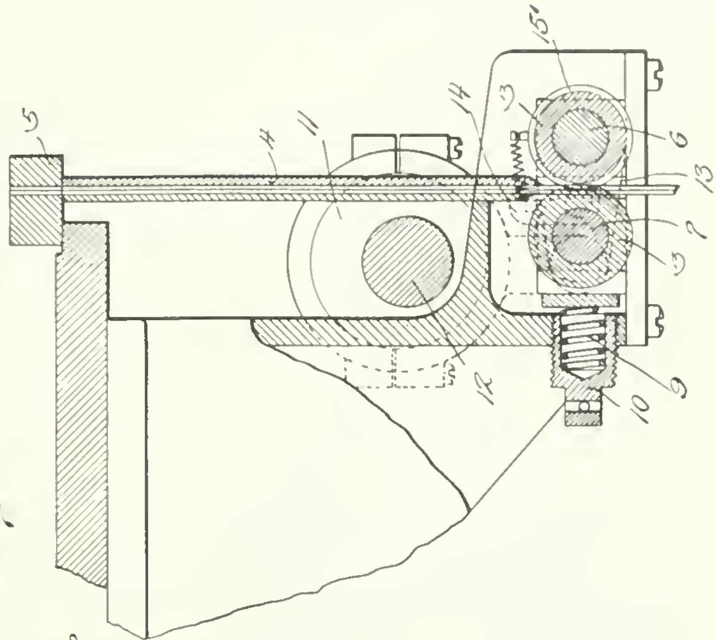

Fig. 7

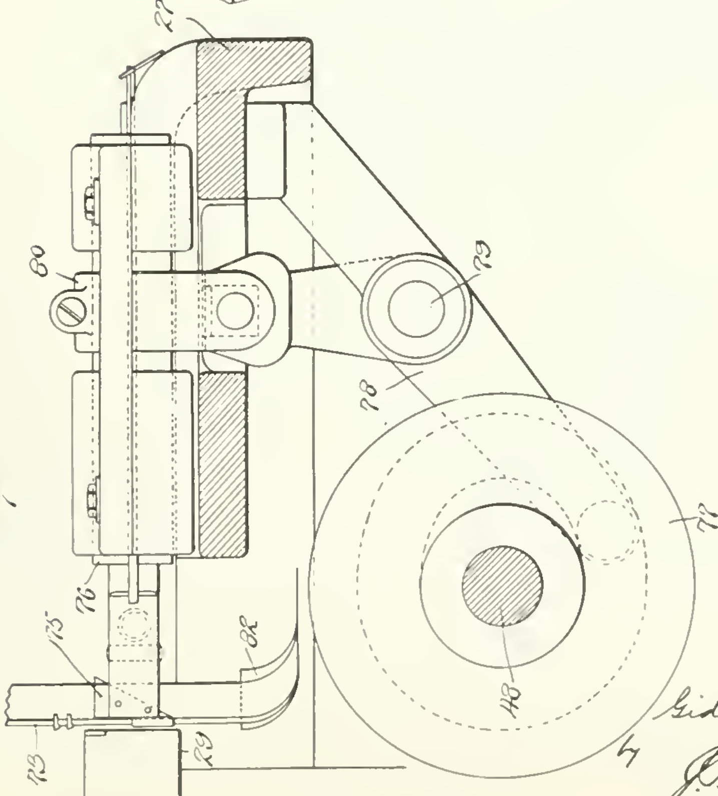

Fig. 16

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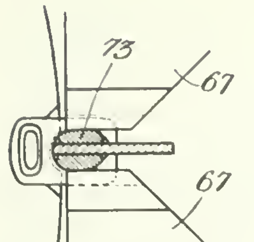


Fig:14.

Fig:8.

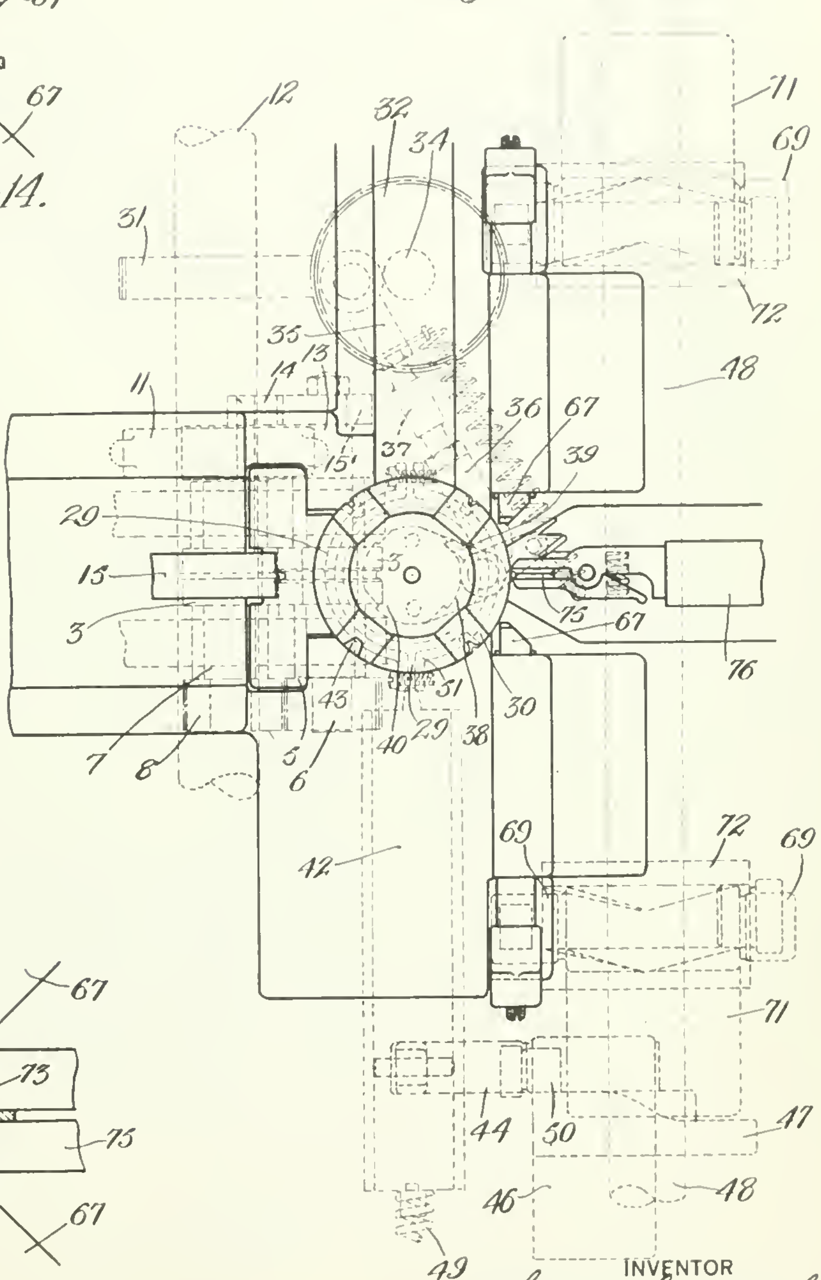
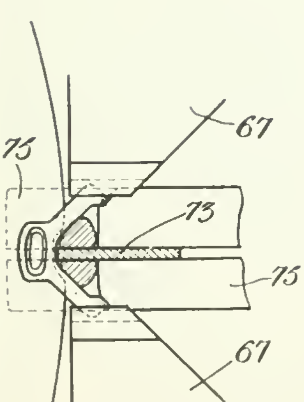


Fig:13.



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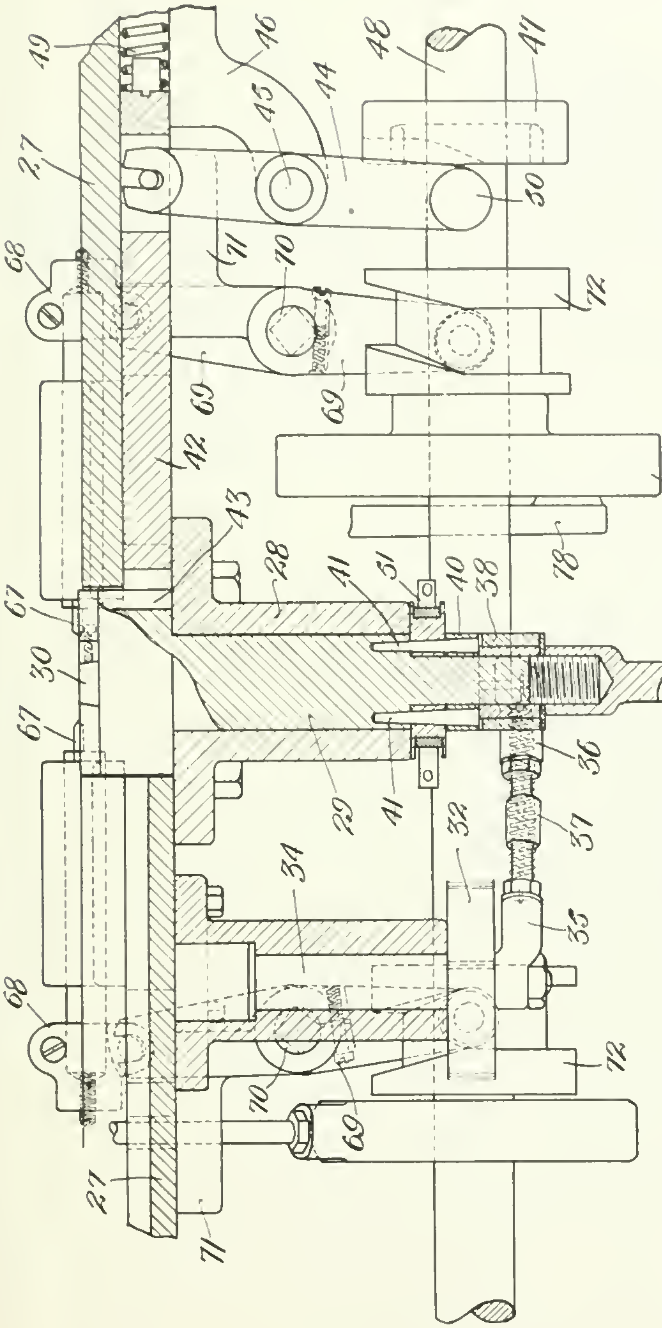

Fig. 10.

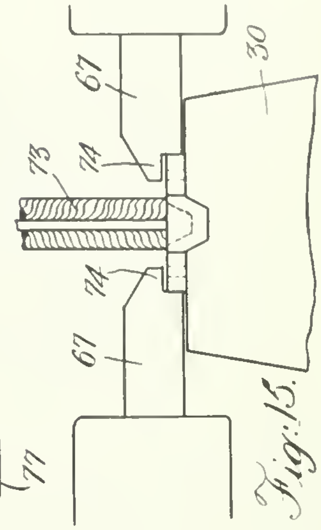

Fig. 15.

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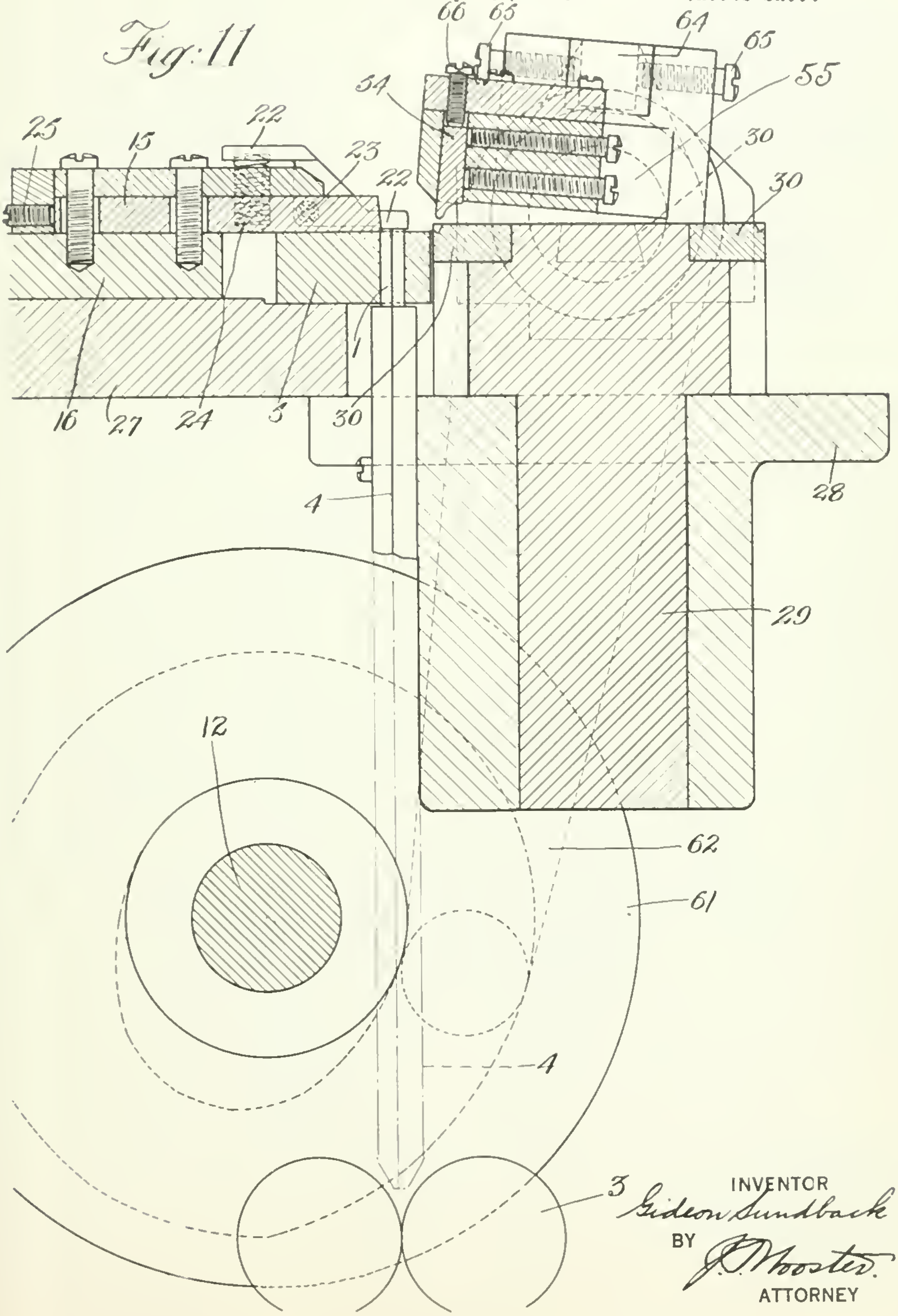
Fig: 11



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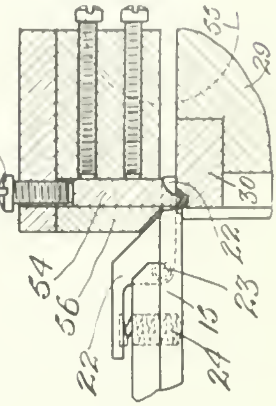

Fig. 21.

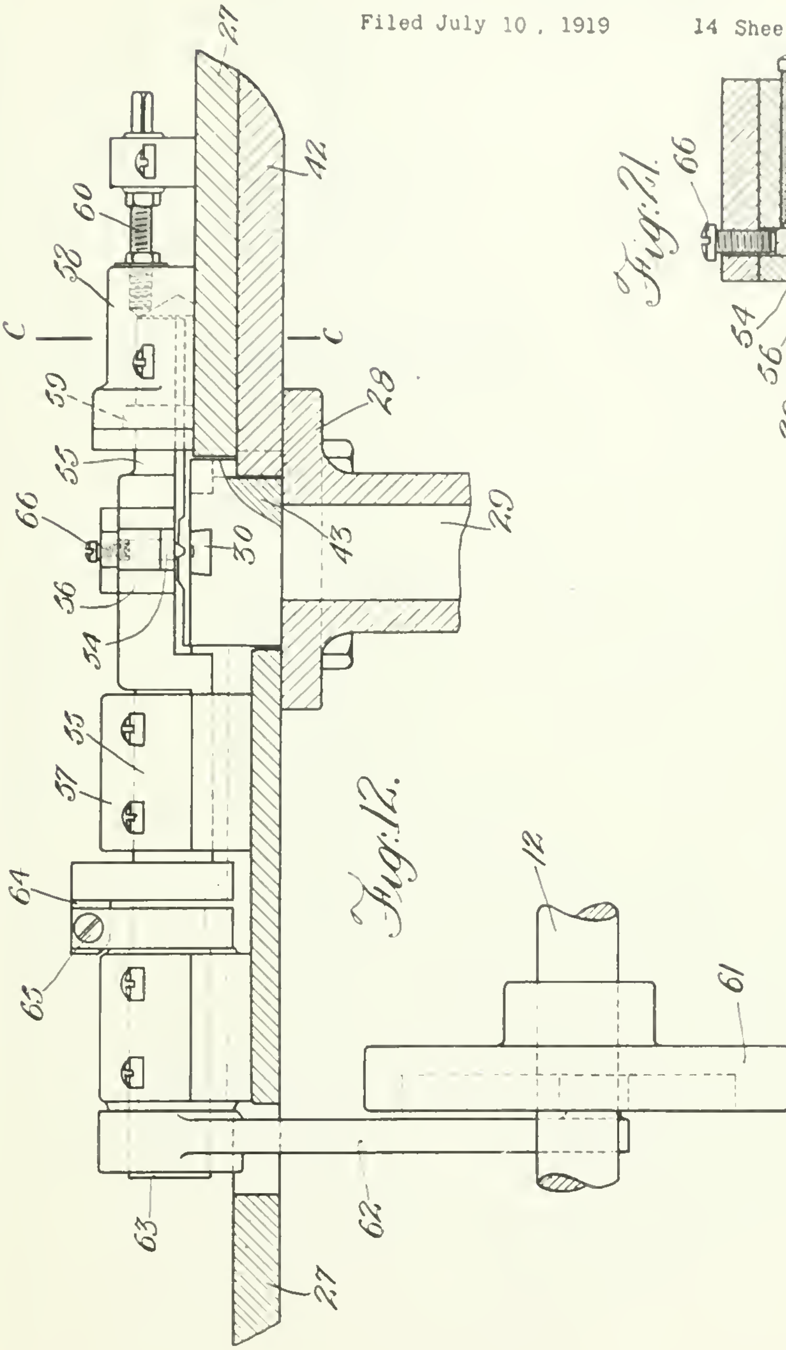

Fig. 12.

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METHOD AND MACHINE FOR MAKING FASTENERS

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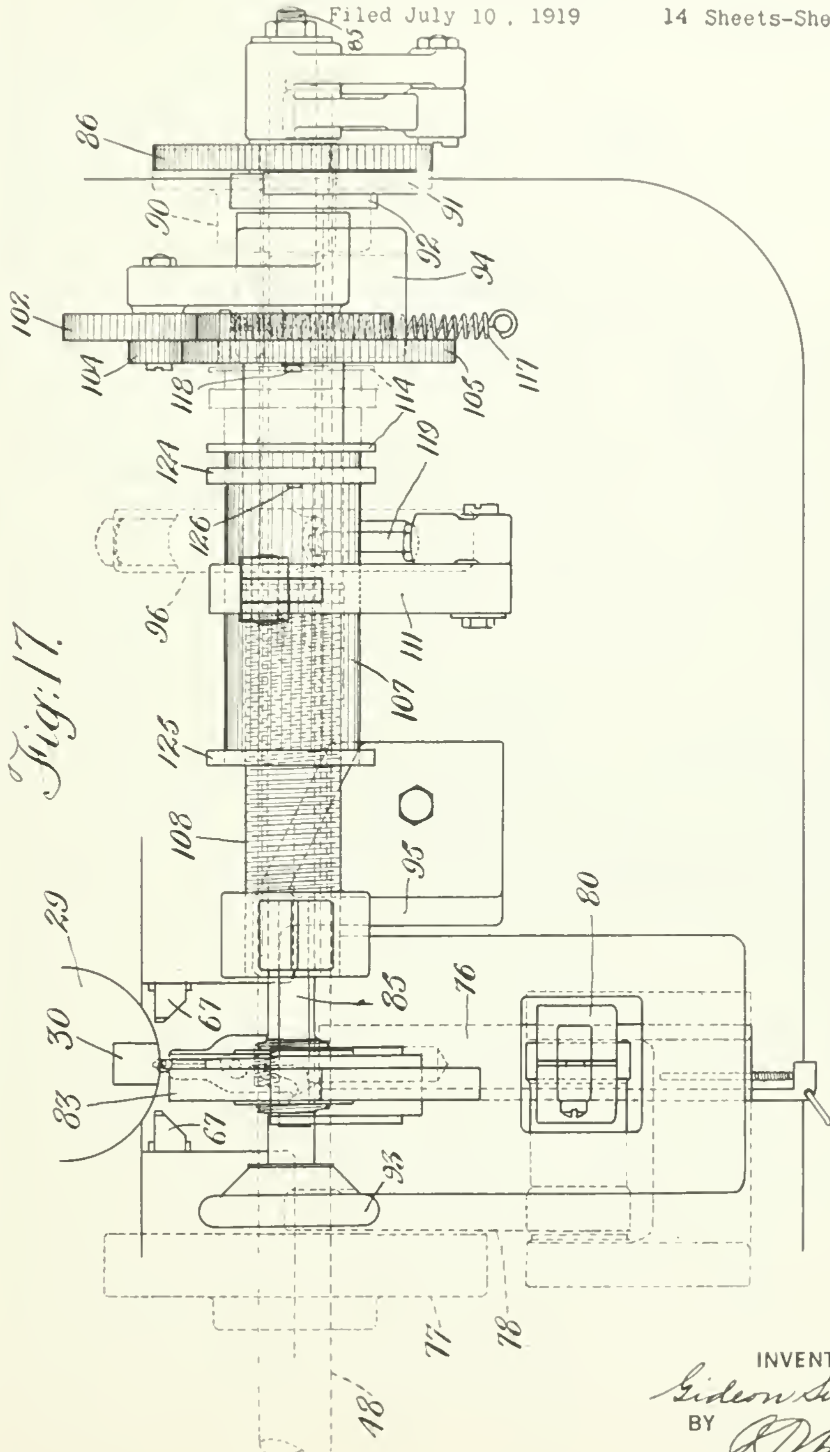

Fig. 17.

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METHOD AND MACHINE FOR MAKING FASTENERS

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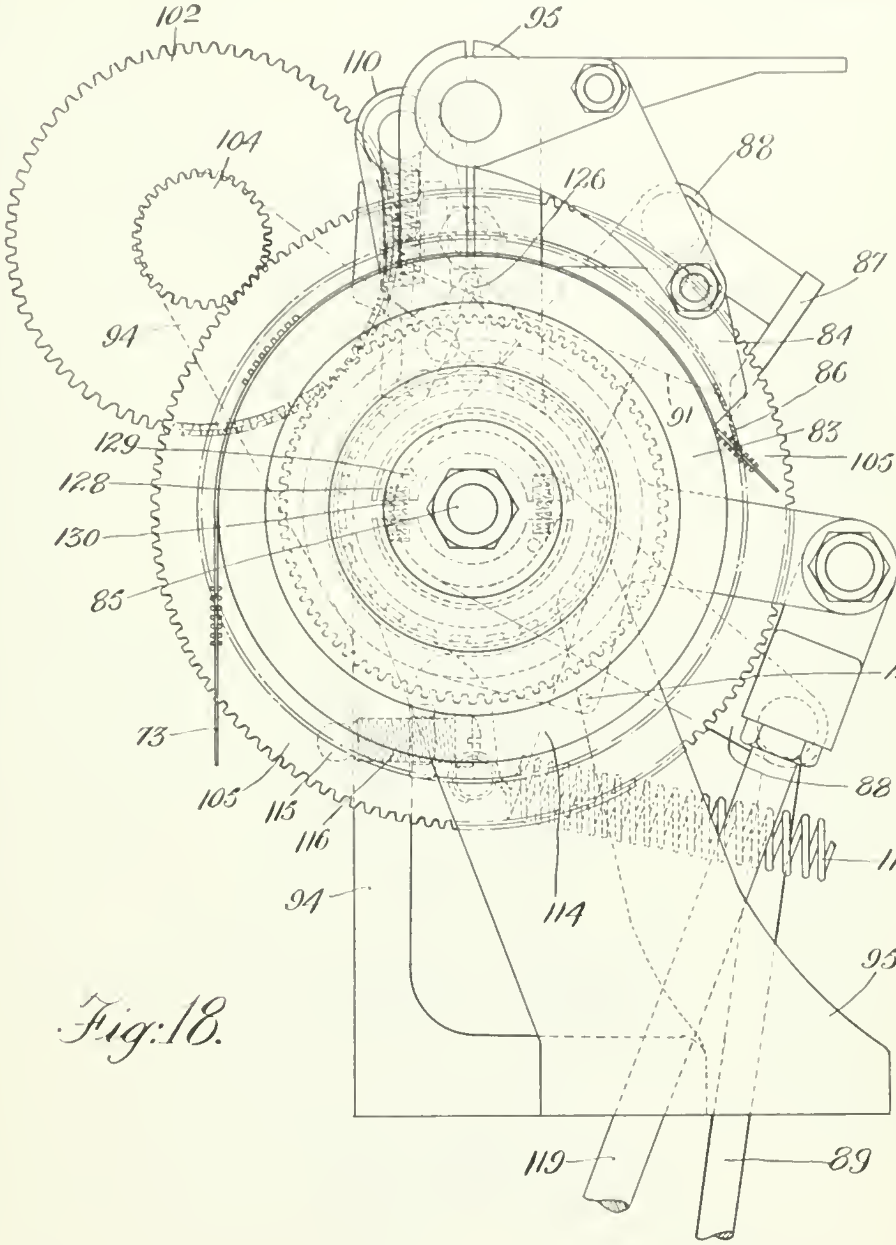

Fig:18.

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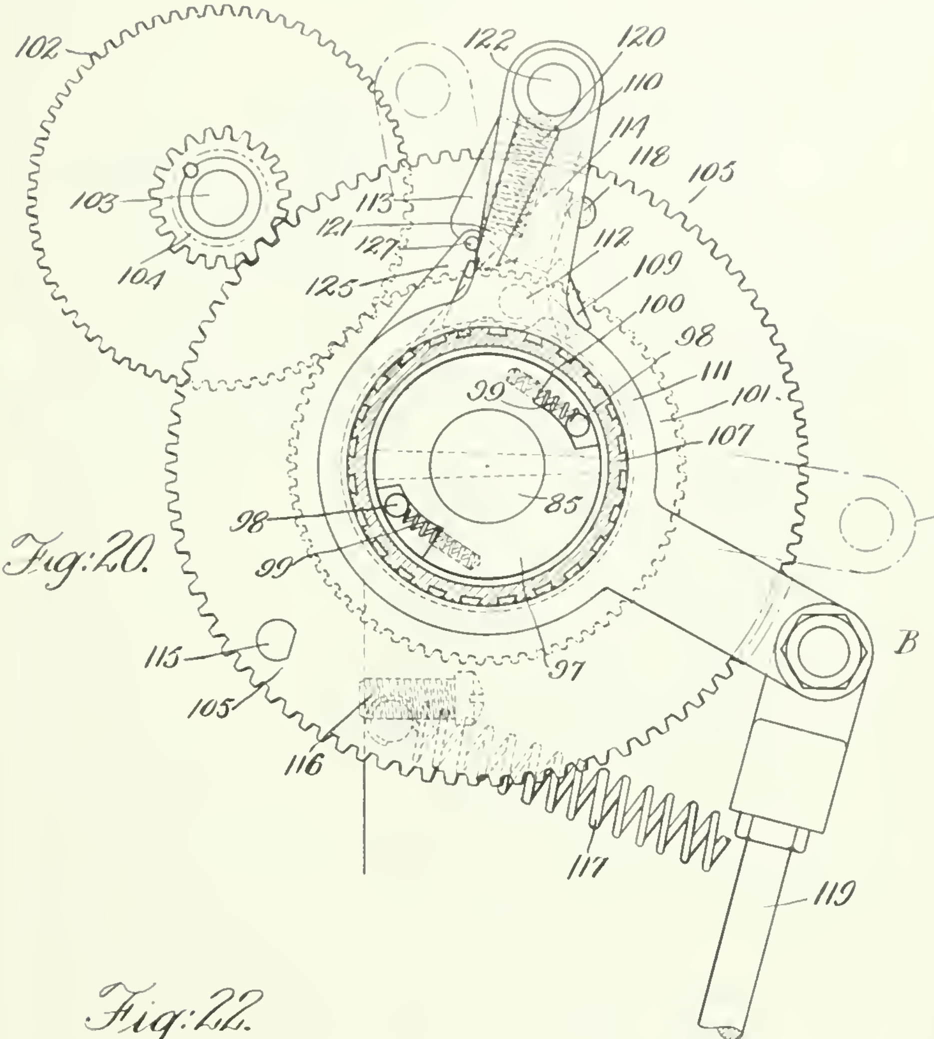
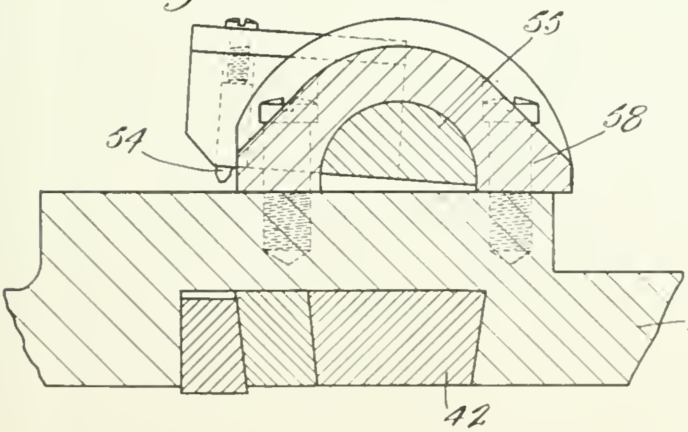


Fig:20.

Fig:22.



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METHOD AND MACHINE FOR MAKING FASTENERS

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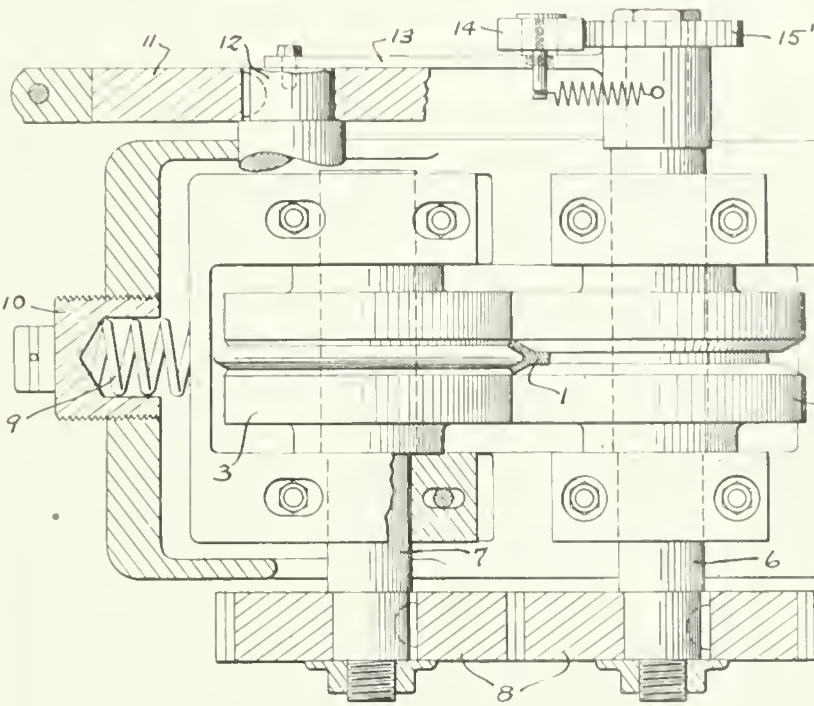

Fig. 24

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Patented Sept. 4, 1923. **1,467,015**

UNITED STATES PATENT OFFICE.

GIDEON SUNDBACK, OF MEADVILLE, PENNSYLVANIA, ASSIGNOR TO HOOKLESS FASTENER COMPANY, A CORPORATION OF PENNSYLVANIA.

METHOD AND MACHINE FOR MAKING FASTENERS.

Application filed July 10, 1919. Serial No. 309,985.

To all whom it may concern:

Be it known that I, GIDEON SUNDBACK, a subject of the King of Sweden, and a resident of Meadville, in the county of Crawford and State of Pennsylvania, have invented certain new and useful Improvements in Methods and Machines for Making Fasteners, of which the following is a specification.

This invention relates to a machine for shearing, forming and setting metallic pieces, and has particular reference to a special form of automatic machine with blank feeding means whereby small pieces are severed or sliced off a metallic strip of predetermined cross sectional shape, formed as by a die, and then set on a carrying element, without at any time losing control of the small pieces.

The machine illustrated herein is intended for making the fastener members shown in my Letters Patent No. 1,219,881, dated March 20, 1917, and affixing them to the corded fabric tape shown therein. The fastener member blanks consists of a body carrying separated jaws, and provided with a recess on one side and a head on the other, these respective recesses and heads being arranged on a pair of tape stringers so as to alternately interlock through a slider mounted on both stringers.

The machine of the present invention has for one of its objects to shear blanks from a strip of metal of predetermined Y cross section substantially that of the finished article, and to perfectly form the recess and head without distortion by the provision of a positive support on all sides of the blank while the forming is done.

In producing a fastener such as described in said patent, extreme accuracy and uniformity in the members themselves is required, and also in the spacing on the stringers, in order that the fastener as a whole will function properly. Also it is desirable to obtain maximum strength in the fastener members with a minimum of material, which is accomplished by first determining the desired cross section of the blank strip to give the minimum practicable width, and then the thickness of the blank for the desired rigidity of the jaws.

Another object is the elimination of all waste or scrap in the manufacture.

Another object is the elimination of delicate blanking tools whereby greater productive capacity at an equal speed is obtained and the expense for the upkeep of the machine is reduced.

Still another object is the positive setting of an accurately predetermined number of fasteners accurately spaced upon a carrying element, such as the stringer of the aforesaid patent.

And still another object is to provide a machine in which the thickness of the members can be varied to permit of an increased strength when desired. Such variation is not possible in a machine punching the members out of the flat stock, for the thickness of the strip suitable for punching is limited, and there is higher cost of operation due to wear of punches, etc., and waste of material.

Referring to the accompanying drawings and to the various views and reference signs appearing thereon:

Fig. 1 is an end view of the machine.

Fig. 2 is a plan view.

Fig. 3 is a sectional view showing details of the cutting punch slide.

Fig. 4 is a sectional detail of the cutting punch slide as shown in Fig. 3.

Fig. 5 is a top view of the cutting punch slide.

Fig. 6 is an enlarged view of the cutting punch and pressure plates.

Fig. 7 is a sectional view showing details of the metal feed.

Fig. 8 is a detail top view.

Fig. 9 is an enlarged top view showing a fastener member positioned in the forming die.

Fig. 10 is a sectional side view on line B—B in Fig. 2.

Fig. 11 is a sectional end view showing forming tool details.

Fig. 12 is a sectional side view on line B—B showing the operation of forming punch.

Fig. 13 is a detail top view of a fastener member in position to be clamped on the tape.

Fig. 14 is the same view showing the clamping operation completed.

Fig. 15 is a side view of Fig. 13.

Fig. 16 is a sectional end view showing horizontal tape slide details.

Fig. 17 is a top view showing tape feeding mechanism.

Fig. 18 is an end view of tape feeding mechanism,

Fig. 19 is a sectional side view of tape feeding mechanism.

Fig. 20 is a sectional end view showing details of the tape feed.

Fig. 21 is sectional end view showing forming tool details at the moment forming is completed.

Fig. 22 is a section on line C—C Fig. 12.

Fig. 23 is an enlarged view of the forming die.

Fig. 24 is a detail plan view of the feed roll mechanism shown in Fig. 7.

In carrying out my invention I feed, as by friction rolls, a metallic strip of special alloy of predetermined cross section through a guide to shear or slice off blanks by means of a reciprocating knife having edges that somewhat conform to the section of the strip. The cutting knife carries spring plates that hold the cut blank against the knife to enable the knife to feed the blank to a revoluble set of forming dies, which form a recess on one side and a head on the other, while supported on all sides to prevent distortion. The forming die which still retains the formed blank is then rotated away from the knife to a position where the jaws of the formed member can be clamped to a carrier or a tape. The tape is synchronously fed and carries the set member away from the die. The feed of the tape is also periodically varied to form regular spaced groups each of a predetermined number of members, ready to be severed to form the pairs of stringers constituting each fastener.

Referring to Figs. 6, 7 and 8, 1 is a wire of channel shaped cross section, usually of non-rusting alloy, and so rolled or drawn as to have the sides of the channel of such section as to constitute the jaw members of the fastener members without any further operation thereon. This wire unwinds from reel 2, Fig. 1, and is fed step wise by friction rolls 3 through the guide 4 and cutting die 5. The rolls 3 are grooved to fit the shape of the wire and are mounted on shafts 6 and 7 and connected by gears 8. The friction between the rolls and the wire is adjusted by the pressure of spring 9 through the screw 10. The movement of the rolls is effected by the eccentric 11 on shaft 12 oscillating the rocker 13 pivotally mounted on shaft 6 and carrying the pawl 14. The latter acts on the ratchet 15′ also mounted on shaft 6 and thereby effects an intermittent movement of the metal strip 1. The amount of this feed constitutes the thickness of a fastening member blank and is predetermined in proportion to the spacing of such members on the tape and to the required strength of the jaw members, and can be readily changed where desired without involving waste.

Referring to Figs. 3, 4 and 5, 15 is a cutting or shearing knife with its cutting edge preferably shaped to partially conform to the blank strip 1. This knife is mounted in slide 16, mounted on table 27 and is moved back and forth by cam 17 on shaft 12 through levers 18 and 19, both of which are fastened to shaft 20 rocking in bracket 21. The strip blank 1, is so positioned relatively to the knife 15 that the latter cuts from the jaw end toward the body end for the purpose of not distorting the jaws in cutting, and also so that the jaws will be in proper relation to the tape when clamped, without requiring the blank member to be turned around, and without getting out of control. Attached to extensions of slide 16 on each side of knife 15 are spring plates 22 pivoting on 23 constituting a presser foot mechanism, and acted on by compression springs 24. The knife 15 is adjusted laterally by set screw 25, Figs. 5 and 11, in desired proximity to plates 22, see Fig. 6, and retains its position relatively to the plates during the forward and back movements of the slide 16. The slide 16 has the adjusting screw 26.

Referring to Figs. 8 and 10, revolving in the bracket 28 and table 27 is the column 29 which carries the forming dies 30. The spiral gear 32 on shaft 34, driven by spiral gear 31 on shaft 12, acts as a crank plate and through the studs 35 and 36 connected by turnbuckle 37 reciprocates the rocker arm 38. The latter carries pawl 39 which acts on the ratchet 40 fastened by pins 41 to the column 29. As the spiral gear 32 revolves the pawl 39 catching in the teeth of ratchet 40 intermittently revolves the column 29 and brings in rotation the forming dies 30 into the positions illustrated in Fig. 5.

Referring to Figs. 8, 10 and 5, 42 is a slide mounted in the table 27 with its front end shaped to fit into a slot 43 in column 29. This slide is operated through the lever 44 mounted pivotally at 45 in bracket 46 by the single faced cam 47 revolving with shaft 48 on one hand and compression spring 49 on the other. When one of the dies 30 reaches the position as shown in Fig. 5, corresponding slot 43 comes into line with the tapered end of slide 42, the spring 49 moves the slide 42 forward into slot 43 as governed by the cam 47 and thereby locks the column 29 and dies 30 in position. The lock is released when the cam 47 revolves sufficiently to withdraw the slide 42 from the slot 43 against the pressure of spring 49. The column 29 is held against the back stroke of pawl 39, or accidental movement by brake 51. A hand wheel 53 is provided for turning the column 29 in setting or adjusting the dies 30 when the machine is not in motion.

Referring to Figs. 11, 12 and 22, 55 is a shaft with a crank 56 which forms a holder for the forming punch 54. This shaft rocks in bearing 57 and is supported by bearing 58 and is also axially fixed in the latter by collar 59 and axially adjustable by set screw 60. The rocking movement between the upper position of punch 54 as shown in Fig. 11, and the lower position as shown in Fig. 21, is imparted by cam 61, through lever 62, shaft 63 and coupling 64. When the forming punch is in its lower position the crank 56 in the shaft 55, adjusted by the coupling screws 65, exerts pressure on the plates 22, Figs. 6 and 21, and press the jaws of the fastener member firmly into position, and prevent distortion while the forming of the head is taking place. The punch 54 is vertically adjustable by the set screw 66, Figs. 8, 11 and 21.

Referring to Figs. 8, 11 and 6, while the column 29 is in motion and one of the dies 30 is approaching the position directly opposite the cutting knife 15 and die 5 shown in Fig. 5, the slide 16 starts the forward movement toward the column 29. The blank strip 1 is fed up with its end extending above the cutting die 5 by an amount equaling the peripheral travel of rolls 3 during a single movement thereof, or the thickness of a fastener member. The cutting knife 15 on its way forward now shears off the projecting end of blank strip 1 against the edge of cutting die 5. The plates 22, the operating end of which have been lifted by the blank strip 1 as it was fed up, are by action of the springs 24 holding the end of the metal strip to prevent displacement or ejection of the fastening member blank at the moment the cutting operation is completed. Likewise the plates 22 continue to hold the blank flat against the top of the cutting die as it is next fed forward toward the column 29 by further movement of cutting knife 15. As the column 29 stops, and the blank propelled by the cutting knife 15 on slide 16 nears the die 30 in the column 29, the locking slide 42 enters slot 43, Fig. 12, to lock the column and dies 30 in position. As the fastening member blank moves into the forming die, as illustrated in Fig. 9, the forming punch 54, Fig. 11 starts on its downward stroke and while the fastening member is held in position and confined on all sides by the cutting knife 15, plates 22 and the forming die 30, Figs. 9 and 21, the forming of the recess and projection of the member is completed, whereupon the cam 61 releases the pressure on plates 22, simultaneously lifting the punch 54; the locking slide 42 withdraws from the slot 43 and slide 16 draws back the plates 22 and cutting punch 15. The fastener member stays in the die 30, which is now free to move with the column 29 as it starts its rotary movement in an anti-clockwise direction as viewed in Fig. 8. When the slide 16 reaches its extereme outer position with the cutting knife 15 returned to initial position, see Fig. 6, the rolls 3, Fig. 7, feed the blank strip, whereupon the operations are repeated.

The finished fastener members are carried in the dies 30 by the revolving column 29, and as the die stops diametrically opposite to the place where the member was placed in the die, the jaws of the member are clamped around the corded edge of a braid or tape 73 which is fed upward parallel to the blank strip 1. The fastener member, having been attached to tape 73 in the manner above described, is then lifted out of the die by the upward feed of the tape. The tape feed is intermittent, so that the tape will be stationary during the attaching of the fastener member.

Referring to Figs. 8 and 10, 67 are two clamping tools connected with and operated through clamps 68, levers 69, which pivot on the shaft 70 in brackets 71, and double faced cams 72. The latter are keyed to shaft 48. These clamping tools press the jaws of the fastener member together on the corded portion of tape 73 as shown in Figs. 13, 14 and 15. As seen in Fig. 15 the clamping tools have an overhanging lip 74 which holds the fastening member down in the die while the clamping is accomplished. Fig. 13 shows the beginning of the clamping operation, Fig. 14 shows its completion.

Referring to Figs. 13 16 and 17, the tape 73 with corded edge to which the fastening members are clamped runs through a guide 75 which at the same time serves as a tension against the upward vertical feed of the tape. This guide 75 is held in a slide 76 which carries the tape in toward the column 29 and presses the corded edge in between the jaws of the fastening member held in the die 30, Fig. 13, while the clamping tools 67 press the jaws together and then, as soon as the vertical feed has taken place and the fastener member thereby lifted out of the die 30, withdraws the tape from the die into a position shown in Fig. 16 so as to clear the way for a free rotation of the column 29. The movement of the slide 76 is governed by the cam 77 on shaft 48, Figs. 16 and 17, bell crank 78 pivoting on shaft 79 and the adjustable clamp 80 on slide 76.

Referring to Figs. 1 and 2, the tape 73 unwinds from spool 81, passes through the guide 82 and the tension guide 75, Fig. 16, and across the tape roll 83 which, operated in a clockwise direction, as viewed in Fig. 18, controls the vertical movement of the tape 73 in conjunction with the sliding shoe 84, to control the spacing of the members by feeding the tape 73. The tape roll is mounted on shaft 85, Figs. 18 and 19, which is operated by the ratchet 86, pawl 87, bell crank 88 and pitman 89, Figs. 1, 2, 17 and 19, and crankplate 90 keyed onto the end of shaft 48, controlling the tape feed for regular spacing.

The shield 91 and the long stroke of pawl 87 serve as a means of reducing the time of the actual tape feed to a small proportion of the pawl travel, in other words, shortens the time of feeding the tape so as to allow as much time as possible for other operations of the machine. 92 is the support or holder of the shield 91 and at the same time serves as a brake to hold the feed roll 83 against accidental rotary movements. 93 is a handwheel attached to shaft 85, for adjustment purposes.

Referring to Figs. 17, 19 and 20, the special feed mechanism, located between the two housings 94 and 95, is operated by eccentric 96 on shaft 48, to provide for the extra tape feed which produces the blank length of tape between two groups of fastener members. 97 is a friction ratchet on shaft 85, with two rolls 98 and springs 99, constructed like ordinary friction ratchets, so that when the encircling ring or bushing 100 is moved in a clockwise direction as viewed in Fig. 20, the rolls 98 wedge between the spiral surface of the ratchet and the inner surface of the bushing 100, and move the shaft 85 with it, whereas if the bushing moves in an anticlockwise direction or the shaft in a clockwise direction, the binding contact between the two is released. Thus the shaft travels in a clockwise direction during the period of regular spacing of members on the tape without disturbing the position of the bushing 100. Keyed to the bushing 100 is a gear 101 which meshes with the gear 102 and revolving on the stud shaft 103, Figs. 19 and 20. Fastened to the gear 102 and revolving with it on the shaft 103 is the gear 104 which is in mesh with gear 105. The latter is idle on the bushing 100 and held against axial movements by the washer 106. Now if the idle gear 105 is moved in a clockwise direction, as shown in Fig. 20, the motion is transmitted through the meshing gears and the friction ratchet 97 to the shaft 85 so that the tape roll 83 is rotated in the same direction. The extent of the movement of the tape roll as compared with the movement of the gear 105 is determined and adjusted by the selection of the gear ratio. The idle gear 105 carries a stop 115 which abuts against the adjusting screw 116, and is held in that position by the spring 117. The gear 105 also carries the catch 118, threaded into the gear and by reason thereof adjustable in an axial direction. The radial position of the catch is adjusted by the set screw 116.

Referring to Figs. 17, 19 and 20, 107 is a drum threaded on extension 108 of the housing 95. The drum is revolved by the double pawl 109 pivoted at 112 on extension 110 of rocker ring 111, and held in actuating position for rotating the drum in either direction by spring plunger 113. The rocker ring is moved by eccentric 96 through connecting rod 119. Attached to the end of the drum 107 is arm 114. As the drum revolves clockwise as seen in Fig. 20, it moves toward the housing 94, Figs. 17 and 20. The arm 114 revolves with the drum, and when the drum reaches the end of its travel, arm 114 strikes catch 118, Figs. 17 and 20, and moves gear 105 and through the train, friction ratchet 97 and tape roll 83. This movement of the tape roll is ordinarily limited to one step in the rotation of the drum as imparted to it through the rocker arm by one revolution of the machine, but if the blank space of tape between the groups of members should not be sufficient, the drum may be allowed to move the tape roll a few steps in succession. The direction of the movement of the drum 107 is governed by the position of the spring plunger 113. When the latter is positioned in one of the two notches on back of the pawl 109 the spring 120 holds the plunger there and the pawl 109 in the same actuating position revolving the drum until the plunger by action on one of the two levers 121, Figs. 19 and 20, is forced into the other notch and reverses the rotation of the drum. The levers 121 are connected to the spring barrel 123 through the shaft 122. The spring barrel is slidably fitted into and guides the plunger 113.

Referring to Figs. 17 and 19, adjustably mounted on the revolving drum 107 are the rings 124 and 125 carrying the pins 126 and 127 respectively. These rings move spirally with the drum and the pins 126 and 127 are alternately brought against the levers 121, and by pressure on one of these levers, the spring plunger is moved from one actuating position on the back of pawl 109 into the other, always alternating so that the drum keeps constantly moving back and forth between the limits set by the positions of the rings 124 and 125. The position of ring 125 is adjusted so that the pressure of pin 127 reverses the direction of the drum 107 by pressure on the lever 121 at the moment the arm 114 has moved the gear 105 and the tape roll 83 to effect the blank space of tape which determines the end of the fastener stringer. The position of the parts of the mechanism at this moment is illustrated in Fig. 20. The pawl 109 is in position to actuate drum 107 in a clockwise direction, and arm 114 has just moved gear 105 by pressure on catch 118 as the extension of rocker ring 111 made the last trip from its upper position at A to its lower position at B. At the same time pin 127 on ring 125 was moved up to lever 121. As the rocker ring now moves upwards towards its position at A drum 107 is held against the back stroke of pawl 109, and the pressure on pin 127, by an internal brake consisting of a split collar 128 fastened by pins 129 to the housing extension 108 and expanded by springs 130, Figs. 18 and 19. When position A is reached, the plunger 113 will have been forced over into the other notch on pawl 109, starting drum 107 back in the anti-clockwise direction.

As soon as the drum starts the back movement of arm 114, gear 105 is brought back to its original position with stop 115 against set screw 116 by spring 117. The other gears of course move also, but as this is the back stroke of the bushing 100 on the friction ratchet 97, shaft 85 is not disturbed by this backward movement. The drum keeps on travelling anti-clockwise until pin 126 on ring 124 again reverses the direction by pressing spring plunger 113 back to its position illustrated in Fig. 20. The drum thus travels back and forth, and the number of stepwise movements between each movement of the gear 105 is determined by the position of pin 126 on ring 124. In this manner, the length of a fastener can be regulated by exact counting of the fastener members, from two or three in a group, to the limit allowed by the maximum travel of the drum.

Referring to Figs. 1 and 2, shafts 12 and 48 are connected and run at the same speed by gears 131 and 132, and the cams, eccentric, and crank plate on shaft 48 are timed so as to perform the clamping of the fastener members to the tape simultaneously with the shearing of wire 1 on the opposite side of column 29, and so as to feed the tape with the attached fastener member simultaneously with the feed of wire 1. When the column comes to rest and is locked by slide 42, tape slide 76 carrying guides 75 moves the tape towards the formed member located in the die 30 in line with the direction of the slide movement. The clamping tools 67 on each side of the member are set in motion, and when the corded edge of the tape is pressed in between the jaws of the member the clamping tools close in and complete the clamping operation. Immediately the clamping tools commence to withdraw and as soon as the fastener member will clear the overhanging lip 74 of the withdrawing tools, pawl 87 acts on ratchet 86 to feed the tape upward and lift the attached fastening member out of die 30. At the end of the latter operation, the outward movement of slide 76 takes place. The column is released and moved another step which brings a new member in the succeeding die and the operations are repeated.

The machine is driven by pulleys 133, Figs. 1 and 2, and stopped and started by belt shifter 134. 135 is a wheel for turning the machine by hand. Box 136 receives the tape as it is fed out of the machine with fastener members attached.

By the elimination of scrap, 50% of the material required by former machines is saved, and by better distribution of metal in the sheared blanks, 25% more is saved, in making fasteners of equal strength, this latter saving being largely in the thinner jaws permitted by shearing as compared with punching. Also there is a large saving in maintenance, owing to the omission of blanking out punches, and less wear and tear on the shearing knife.

It will thus be seen that this machine will shear blanks of substantially finished cross sectional shape from a strip or metal wire of predetermined cross section without any waste or scrap and also perfectly form the recess and projection, as the positive support on all sides during the punching or forming will prevent any distortion. The machine by means of the rotatable die column cooperating with setting punches and an accurately controlled and synchronized tape feed will set the blanks upon a carrier in such a manner that the blanks are in accurately spaced groups of blanks and which are of predetermined number of blanks in each group.

The shape of the member is governed by the cross sectional shape of the metal strip and hence the machine is adapted to make members of different shape and for different purposes than the fasteners herein indicated and I do not desire to be limited in this respect. Certain mechanisms might be omitted, such as the forming punch, in the manufacture of other forms of fasteners or the carrier and feeding device.

Having now set forth the object and nature of my invention and various arrangements embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent is:

1. The combination with means for severing a blank member from the end of a strip, of means for affixing said member to a tape.

2. The combination with means for severing a blank member from the end of a strip, of means for shaping the blank, and means for feeding out said member from said shaping means.

3. The combination with means for severing a blank member from the end of a strip, of means for feeding the member to a die, means for shaping the member, and means

for feeding out said member from said shaping means.

4. The combination with means for feeding a blank strip, of means for severing a blank member from the end of said strip, means for shaping the member and means for feeding out said member from said shaping means.

5. In a machine for making fasteners, the combination with means for severing successive lengths from a wire, of means for deforming each severed length to provide interlocking surfaces, and means for bending and clamping said severed length upon a tape.

6. The combination with intermittent means for feeding a blank strip, of a reciprocating knife for slicing blank members from the end of said strip and holding the cut blanks while feeding them to a die, means for forming said member in the die, and means for feeding out the formed member from said die.

7. The combination with means for feeding a blank strip, of means for severing a blank from the end of said strip and holding said blank to prevent distortion while it is being shaped, means for shaping said blank, and means for feeding out and setting the formed member on a carrier element.

8. The combination with means for feeding a strip of predetermined cross sectional shape, of means for slicing a blank member from the end of said strip and holding it to prevent distortion while being formed, means for forming said member, means for setting said member on a carrier element and means for feeding the carrier element and attached member away.

9. The combination with intermittent strip feeding means, of means for severing an entire cross sectional part of the strip, forming means for the severed pieces, and means for holding the severed pieces against spreading while being formed.

10. The combination with intermittent strip feeding means, of a knife for severing a blank jaw member from the end of the strip, means for feeding forward said jaw member, means for forming a recess in said member, and means for feeding the said member out of the machine.

11. The combination with intermittent strip feeding means, of a knife for slicing off a blank jaw member from the strip, means for feeding forward said jaw member, means for forming a projection on said member, and means for feeding the said member out of the machine.

12. The combination with means for slicing a blank fastener member from a strip, said strip having its cross section predetermined to provide a pair of separated jaws on the fastener member, of means for feeding a carrier element between said jaws, and means for pressing the jaws together on said element.

13. A machine for forming jaw shaped interlocking fastener members, comprising in combination means for intermittently feeding a grooved wire, a knife for severing successive blanks from said wire and for guiding a severed blank to a forming die, a forming die, and a punch to deform the material of said severed blank at the vertex of its groove to form opposite interlocking surfaces.

14. The combination with means for slicing a member from a strip, said strip having its cross section predetermined to provide a pair of separated jaws on the member, means for inserting the edge of a tape between said jaws, and means for pressing the jaws together on the tape.

15. The combination with means for feeding a strip of Y cross section, of means for slicing a blank therefrom having jaws and a body, means for feeding the blank into a die, means for forming the body with a recess on one side and a head on the other, means for feeding a tape between the jaws, and means for setting the jaws on the tape.

16. The combination with means for feeding a strip of predetermined cross section, means for slicing off members having jaws, means for feeding a continous tape between said jaws, means for pressing said jaw members on said tape, and means for varying the feed of said continuous tape to vary the spacing of said members.

17. The combination with means for feeding a metal strip of irregular cross sectional shape, of means for slicing from said strip an element having separated jaws at its forward end, means for attaching said jaws to a carrier.

18. The combination with means for severing members from the end of a metal strip of predetermined cross sectional shape, of means for affixing said members to a strip in accurate spaced relationship.

19. The combination with means for slicing members from a metal wire of irregular cross section, of means for affixing said members to a strip in accurate spaced relationship, and means for varying the spacing to form groups of members of a predetermined number.

20. The combination with means for feeding a strip a predetermined amount, of means for severing a blank member from the end of said strip, means for shaping the member, and means for feeding out said member from said shaping means.

21. The combination with means for slicing a member of any predetermined thickness from a strip, of means for shaping the member and means for feeding out said member from said shaping means.

22. The combination of a cutting die hav-

ing an orifice, means for feeding a wire having an indented cross section through said orifice, the latter being shaped to accommodate said wire, a knife having a cutting edge shaped to engage the indentation of said wire, means for reciprocating said knife across the face of said cutting die to cut off successive lengths from said wire, and means for attaching said lengths to a tape.

23. The combination of a cutting die having an orifice, means for intermittently feeding a wire having an indented cross section through said orifice in predetermined lengths, a knife having a cutting edge shaped to engage the indentation of said wire, means for reciprocating said knife across the face of said cutting die to slice each length of wire fed through the orifice to form a blank fastener member, means for shaping said member, and means for holding said member with its indented portion against the corresponding portion of the knife edge to prevent distortion while shaping.

24. The combination with means for feeding a strip, means for severing a member from the end of the strip, means for holding the member against said severing means to permit the member to be fed forward thereby, means for shaping said member, and means for feeding out said member from said shaping means.

25. The combination with means for feeding a strip, of means for severing a section from said strip to form a blank fastener member, a rotatable column, a die mounted on said column, a punch, means for actuating said punch to engage said die, spring plates cooperating with said severing means to feed said member to said die and to hold said member in the die during the actuation of the punch, means for setting the member on a tape, means for rotating the column to feed the member from said punch to said setting means, and means for feeding the tape.

26. The combination with means for feeding a strip, of means for severing a section from said strip to form a blank fastener member, a rotatable column, a die mounted on said column, a punch, means for actuating said punch to engage said die, spring plates cooperating with said severing means to feed said member to said die and to hold said member therein during the actuation of said punch, means for locking said column during the actuation of the punch, means for setting the member on a tape, means for unlocking and rotating the column to feed the fastener member from the punch to the setting means, and means for feeding the tape.

27. The combination with means for feeding a strip of predetermined cross section, means for severing a member from said strip, a punch and die for forming said member, spring plates cooperating with said severing means and said die to hold said member during the forming to prevent distortion, and means for feeding out said member from said die.

28. The combination with means for severing a member from a metal strip of irregular cross section, means for shaping the member, tape feeding means, means for setting said member on said tape and means to vary the tape feed to vary the spacing of the members on said tape.

29. The combination with means for severing a member from a metal wire of predetermined cross sectional shape, means for clamping said member to a tape, the said clamping means having overhanging lips to hold said member during the clamping.

30. In a machine for making fasteners, a revoluble column having a plurality of dies, means for feeding blanks to said dies, means for forming the blanks, and means for attaching the formed blanks to a carrier.

31. The combination with means for severing blanks from the end of the wire, of a revoluble column having a plurality of dies, means for feeding blanks to said dies, means for forming the blanks and means for attaching the formed blanks to a carrier.

32. A machine for making jaw fastener members comprising in combination a movable die in which said members are adapted to be deformed to provide an interlocking surface, means for intermittently feeding the members to said die, and means for moving said die after the formation of said interlocking surface for affixing the members to a tape.

33. The combination of a rotatable column having a plurality of dies, means for feeding blanks to the dies, means for forming the blanks in the dies, means for feeding a tape, means for attaching the formed blanks to said tape, means for intermittently rotating the column to bring the formed blanks into position for so attaching, and means for holding the tape away from the column during the rotation of the latter.

34. The method of making fastener members which comprises forming a strip of predetermined cross section, slicing blank members from the end thereof, forming said members to provide interlocking surfaces, and setting said formed members on a carrier by distortion.

35. The method of making fastener members which comprises forming a strip of predetermined cross section, slicing blank members from the end thereof, forming interlocking surfaces on each blank member, and compressing said members on a carrier independently of said interlocking surface.

36. The method of making fastener members which comprises forming a strip hav-

ing an indented cross section, slicing the blank fastener members from the end of the strip, forming the vertices of said members into socket and head portions, and clamping said formed members upon a carrier inserted in the indentations.

37. The method of making fastener members which comprises forming a channelled strip, slicing blank members from the end of the strip having jaws formed by the channel sides, and clamping said jaws upon a tape inserted therebetween.

38. The method of making jaw member interlocking fasteners, which comprises severing a strip from the end of a wire and simultaneously feeding the strip toward a die, deforming said strip to provide an interlocking surface and moving the deformed strip to a carrier.

39. The method of making fastener member blanks, which comprises slicing such members successively from a preformed strip of cross section approximating the outline of the blank member.

40. The method of making fastener members which comprises slicing blank members from a preformed strip of generally Y-cross section, the blanks each having a base and a pair of arms, said arms and base being arranged in accordance with the Y-cross section of the strip, forming a socket and a head in the base portion of each blank, and compressing the arms of the member on a carrier.

41. In a machine for making interlocking fastener jaw members, the combination with means for severing successive blanks from the end of a wire, of a movable die, means for moving a severed strip onto said die, punching means adapted to cooperate with said die to form an interlocking surface on said strip intermediate the material of the jaw portions, and means for adjusting the alignment between the die, punching means, and strip moving means.

42. In a machine for making interlocking fastener jaw members, the combination with means for severing successive strips from the end of a wire, of a movable die, means for moving a severed strip onto said die, punching means adapted to cooperate with said die to form an interlocking surface on said strip intermediate the material of the jaw portions, and means for locking the die in position for punching.

43. In combination with means for intermittently feeding a tape in the direction of its length, means for clamping a fastener member on said tape during each pause in the feed thereof, means for feeding fastener members to said clamping means, and means for effecting a transverse movement of said tape during each actuation of said fastener feeding means to clear the latter.

44. In a fastener attaching machine, a tension device for holding a tape, means for intermittently feeding a tape lengthwise through said tension device, means for clamping a jaw shaped fastener member upon the tape during each pause in the movement thereof, means for feeding fastener members to said clamping means, and means for reciprocating said tension device during each pause in the feed of said tape to effect clearance between the tape and the fastener feeding means.

45. In a fastener attaching machine, a tape control, comprising a tension device, means for intermittently feeding a tape through said tension device, automatic means for reciprocating said tension device during each pause in the feed of said tape, and means for affixing the fastener to the tape.

46. In a machine for forming blanks, a rotatable column having a plurality of dies, means for feeding the blanks to said dies, means for forming the blanks in the dies, means for attaching the formed blanks to a carrier, and means for rotating the column to bring the blanks into position for so attaching.

47. The combination with means for cutting blanks, of a rotatable column having a plurality of dies, means for feeding the blanks to said dies, means for forming the blanks in the dies, means for attaching the formed blanks to a carrier, and means for rotating the column to bring the blanks into position for so attaching.

48. The combination with means for slicing blanks from a strip having its cross section predetermined to give a desired outline to the blanks, of a rotatable column having a plurality of dies, means for feeding the blanks to said dies, means for forming the blanks in the dies, means for attaching the formed blanks to a carrier, and means for rotating the column to bring the blanks into position for so attaching.

49. The combination with means for intermittently feeding a strip having a preformed uniform cross section, of means for slicing successive blank members therefrom having the outline of said cross section, and including compressible jaw members, means for feeding a carrier element and the blank member jaws together, and means for compressing the jaws on the carrier element.

50. The combination with means for intermittently feeding a strip having a preformed uniform cross section, of means for severing successive blank members therefrom having the outline of said cross section, and means for forming the blank members to a predetermined shape within said outline.

51. The combination with means for intermittently feeding a strip having a preformed uniform cross section, of means for

severing successive blank members therefrom having the outline of said cross section, means for forming the blank members to a predetermined shape, means for attaching the formed members to a carrier, means for feeding the sheared members from said shearing means to said forming means and thence to said attaching means, and means for feeding the carrier.

52. The combination with means for intermittently feeding a strip, of means for severing successive members therefrom, each of said members having the same outline as the cross section of the strip, means for attaching the severed members to a carrier, means for feeding the severed members from said severing means to said attaching means, and means for feeding the carrier.

53. A machine for forming jaw members comprising in combination means for intermittently feeding a grooved wire, a forming die, a knife for severing successive strips from said wire and for guiding a severed strip to said die, means adapted for cooperation with said die to deform the material at the vertex of the jaw portions to form an interlocking surface, means for withdrawing the knife and inserting a tape between the jaw portions of said severed strip while in said die, and means for closing the jaw portions on said tape.

54. In a machine for forming jaw fastener members, the combination with means including a die for deforming a blank member intermediate the material forming its jaw portions to provide opposite interlocking surfaces, of means for laterally moving a tape in between said jaw portions for attaching the member to the tape, and for longitudinally moving the tape to remove said member from the die.

55. The combination with means for feeding a strip of predetermined cross sectional shape, of means having an edge complementary to the adjacent side of said strip for slicing from said strip successive flat members having the outline of said cross section, means for forming interlocking surfaces on the successive members while engaged with said slicing means, and means for holding said members during forming to prevent distortion.

56. In a machine for forming jaw fastener members, the combination with means for cutting a strip adapted to form such member, of a die adapted to deform a portion of said strip and produce an interlocking surface thereon, said cutting means being adapted to guide said strip to the die and assist in holding said strip on the die during its deformation.

57. In a machine for forming the connecting members having jaw portions of a slide fastener, the combination with means for severing blank members from the end of a wire, of means for changing the cross section of said members at one portion to provide interlocking parts and means for bending and clamping said members to a tape.

58. In a machine for forming jaw members, the combination with an intermittent wire feeding means, of a knife adapted to sever successive strips from the end of a wire, yieldable means for cooperation with the side of said strip opposite its severed surface during and after said strip is severed, a die in which the material of said strip intermediate its jaw forming portions is adapted to be deformed to provide an interlocking surface and means for clamping said yieldable means to assist in holding said strip in said die.

59. In a machine for making interlocking jaw fastener members, the combination with an intermittent wire feeding means, of a knife adapted to sever successive strips from the end of a wire, a die in which a severed strip is adapted to be deformed intermediate the material of its jaw portions to provide an interlocking surface, and means for guiding said severed strip to the die and for holding the same in position on the die, said last mentioned means including the aforementioned knife.

Signed at New York city, in the county of New York and State of New York, this 7th day of July A. D. 1919.

GIDEON SUNDBACK.

DISCLAIMER

1,467,015.—*Gideon Sundback*, Meadville, Pa. METHOD AND MACHINE FOR MAKING FASTENERS. Patent dated September 4, 1923. Disclaimer filed September 14, 1936, by the assignee, *Hookless Fastener Company*.

Hereby disclaims claims 32, 46, 47, and 54 of said patent.

[*Official Gazette October 13, 1936*]

DISCLAIMER

1,467,015.—*Gideon Sundback*, Meadville, Pa. METHOD AND MACHINE FOR MAKING FASTENERS. Patent dated September 4, 1923. Disclaimer filed March 7, 1934, by the assignee, *Hookless Fastener Company*.

Hereby enters this disclaimer to that part of said specification which is in the following words, to wit:

"The shape of the member is governed by the cross sectional shape of the metal strip and hence the machine is adapted to make members of different shape and for different purposes than the fasteners herein indicated and I do not desire to be limited in this respect. Certain mechanisms might be omitted, such as the forming punch, in the manufacture of other forms of fasteners or the carrier and feeding device."

[Page 5, lines 101 to 110 inclusive.]

And your petitioner further disclaims from the scope of each of claims 1 to 33, inclusive, and 41 to 59, inclusive, any combination or any machine, and from the scope of each of claims 34 to 40, inclusive, any method of making, except one for forming and affixing to a tape carrier slide fastener members such as are described in the sentence beginning in line 24, of page 1 of the specification and reading as follows:

"The fastener member blanks consists of a body carrying separated jaws, and provided with a recess on one side and a head on the other, these respective recesses and heads being arranged on a pair of tape stringers so as to alternately interlock through a slider mounted on both stringers."

[*Official Gazette March 27, 1934.*]

PLAINTIFF'S EXHIBIT No. 22

F. Ulrich Patent No. 2,221,740

Filed Dec. 11, 1937 Patented Nov. 12, 1940

Nov. 12, 1940. F. ULRICH 2,221,740

MANUFACTURE OF SLIDE FASTENER ELEMENTS

Filed Dec. 11, 1937 2 Sheets-Sheet 1

Fig.1.

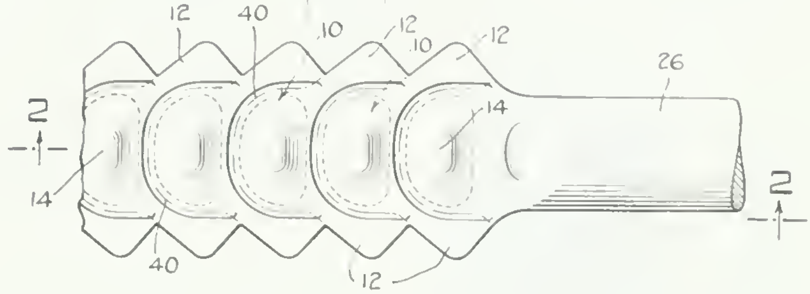


Fig.2.

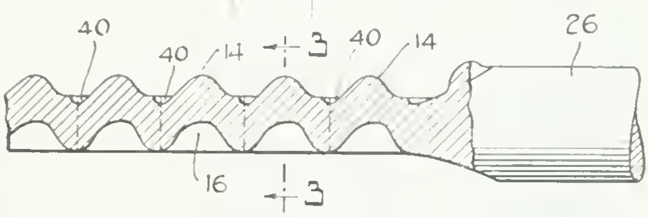


Fig.3.

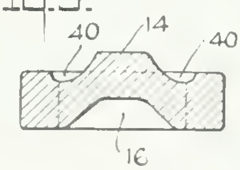


Fig.4.

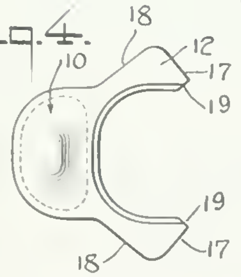


Fig.5.

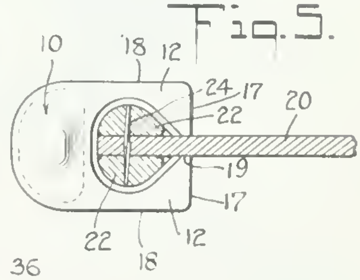


Fig.6.

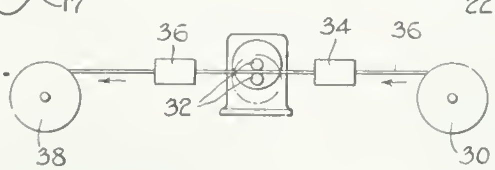
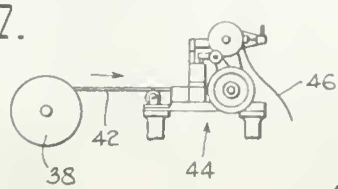


Fig.7.



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MANUFACTURE OF SLIDE FASTENER ELEMENTS

Filed Dec. 11, 1937 2 Sheets-Sheet 2

Fig. 8.

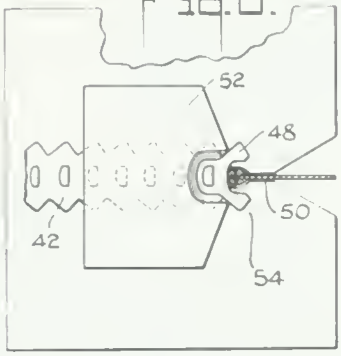


Fig. 9.

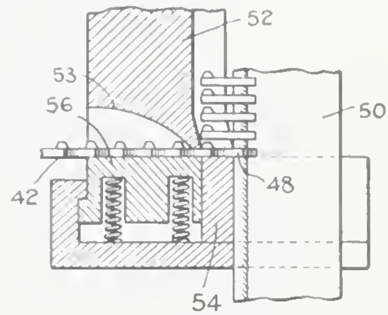


Fig. 10.

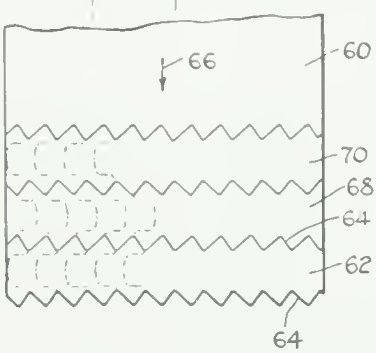


Fig. 11.

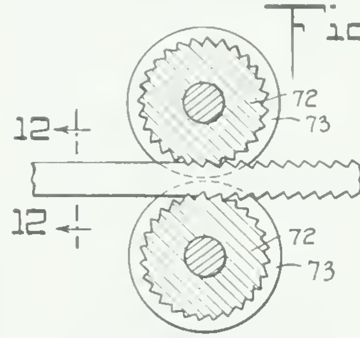


Fig. 12.

Fig. 13.

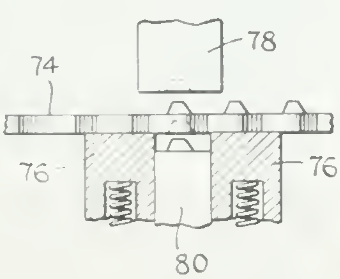
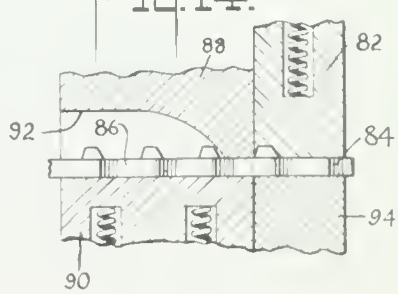


Fig. 14.



INVENTOR
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UNITED STATES PATENT OFFICE

2,221,740

MANUFACTURE OF SLIDE FASTENER ELEMENTS

Frederick Ulrich, Bayonne, N. J., assignor to Conmar Products Corporation, Bayonne, N. J., a corporation of New Jersey

Application December 11, 1937, Serial No. 179,299

23 Claims. (Cl. 29—148)

This invention relates to slide fasteners, and more particularly to the manufacture of the interlocking elements thereof.

The ordinary methods of manufacturing standard slide fastener elements involve a certain amount of scrap or waste material due to the irregular configuration of the elements when in open-jawed condition. This scrap or waste, while apparently small and negligible when dealing with a few elements, becomes very important when the slide fasteners are manufactured in vast amounts under high speed quantity production methods.

The primary object of my invention is to generally improve the manufacture of standard slide fastener elements, particularly with a view to increasing the efficiency and economy of manufacture. By standard elements I mean the most common type in which the jaws have substantially parallel outer edges, with substantially square ends for cooperation with the flanges of the slider. A more specific object is to manufacture such standard slide fastener elements without scrap or waste while making and handling the same in a connected series or continuous wire of embryo elements. A still more particularized object is to make the invention applicable to raw stock of the most conventional and inexpensive character, as for example, a simple round wire of uniform diameter, or a simple flat sheet of uniform thickness. Still another object of my invention is to apply the improvement features thereof to the process disclosed and claimed in a co-pending application Serial No. 215,180 filed by George Wintritz on June 22, 1938, which process is a most efficient, advantageous and desirable one, despite the single disadvantage that it does involve the production of some scrap or waste between the elements, and that disadvantage is eliminated in accordance with the present invention.

To the accomplishment of the foregoing and other more detailed objects which will hereinafter appear, my invention consists in the method steps and the product produced thereby, and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a plan view of a short section of wire showing the manner in which a round wire is formed into a connected series of embryo slide fastener elements;

Fig. 2 is a section taken in elevation in the plane of the line 2—2 of Fig. 1;

Fig. 3 is a transverse section taken in the plane of the line 3—3 of Fig. 2;

Fig. 4 is a plan view of a single finished element made in accordance with my invention;

Fig. 5 is a similar view showing the element clamped to a tape or stringer;

Fig. 6 schematically illustrates the production of the wire by a rolling process;

Fig. 7 schematically illustrates the utilization of the rolled wire for application of the elements to a tape or stringer as the elements are severed from the wire;

Fig. 8 is a plan view schematically illustrating the punch arrangement for separating the endmost element from the wire;

Fig. 9 illustrates the same in side elevation;

Fig. 10 is a plan view showing the manner in which strips of embryo slide fastener elements may be severed from a sheet of material without scrap or waste;

Fig. 11 illustrates an alternative method for forming the desired strip by rolling the same, the edges of a flat wire being rolled to the desired notched or serrated condition;

Fig. 12 is a section through the wire taken on the plane of the line 12—12 of Fig. 11;

Fig. 13 schematically illustrates the formation of the desired interlocking means or projection and recess on the heads of the elements when working in accordance with the processes of Fig. 10 or Fig. 11; and

Fig. 14 schematically illustrates the severance of the finished elements from the strip.

Referring to the drawings, and more particularly to Figs. 1 and 2, I there show a step product obtained when practicing the invention in preferred manner. This step product is an integral strip of embryo fastener elements each having embryo spread jaws 12 and an embryo head generally designated 10. The embryo head is provided with interlocking means, and in the present case, the interlocking means is of conventional type, there being a projection 14 on one side of the embryo head and a recess 16 on the opposite side of the embryo head. It will be noticed on inspection of the drawings that the embryo head of each embryo element is located within and generally conforms to the embryo jaws of the next embryo element, the embryo head 10 substantially filling the space between the spread embryo jaws 12. From another and perhaps more accurate viewpoint, it may be said that the embryo jaws 12 are so widely spaced and spread and so shaped, as to form a space therebetween large enough to receive the embryo head 10.

The shape of the exterior of the jaws also deserves consideration. In Fig. 4 I show the individual element as severed from the continuous strip of embryo elements. This element is applied to a tape as shown in Fig. 5, and it will be noted that when the jaws 12 are changed from the spread position of Fig. 4 to the closed position of Fig. 5, the outer edges 18 change from sharply divergent position to parallel position and preferably are spaced apart an amount substantially equal to the width of the head 10. The ends 17 of the jaws are preferably disposed substantially perpendicular to the outer edges 18 so that when the jaws are closed the ends form a surface which is substantially perpendicular to the tape, as is shown in Fig. 5. The ends are of such dimension that when closed against the tape the sides of the jaws are brought into substantially parallel relation while the ends form substantially perpendicular shoulders for best cooperation with the flanges of a slider. In other words, the element when completed and fastened to the tape does not differ noticeably in appearance from elements made by the more conventional wasteful methods, except perhaps for the shape of the opening between the jaws which receives the beaded edge of the tape. In respect to the inside of the jaws, attention may be directed to the short inner walls 19 which preferably extend generally parallel to the outer walls 18 and generally perpendicular to the end walls 17. With such an arrangement, the inside walls 19 bear directly against the tape when the jaws are closed, as shown in Fig. 5, thus providing a substantial bearing surface to prevent penetration of the tape. The tape may be constructed in accordance with known methods, that here illustrated comprising a woven tape 20 having cords 22 sewed on opposite sides of one edge of the tape as by means of stitching 24.

The desired shaping of the jaws 12 causes the wire or strip of embryo elements to have notched or serrated edges, as is clearly evident from inspection of Fig. 1. As will be developed later, this edge formation may be obtained in a number of ways, but I prefer to obtain the same by pressing and deforming simple round wire stock as illustrated at 26 in Figs. 1 and 2. The deformation of the wire to change it from round to the desired form is preferably done by a rolling process disclosed and claimed in the aforesaid co-pending application Serial Number 215,180 filed by George Wintritz on June 22, 1938. The arrangement is schematically illustrated in Fig. 6, in which the round wire stock 36 is fed from a large supply reel 30 to small diameter pressure rolls 32. Wire straightening and guiding devices are schematically represented at 34 and 36. The rolled wire is wound up on a take-up reel 38. The pressure rolls 32 are matingly recessed and so shaped that in a single rolling operation, the round wire is changed to form the desired projections 14, recesses 16 and jaws 12. The wire is given the desired serrated or notched edge. The embryo heads 10 of the embryo elements may, if desired, be outlined by a trough-like depression or groove 40 (see Figs. 1, 2 and 3), but this is not essential. The object of this groove is to help properly finish the shaping of the heads of the elements to desired configuration, and also to facilitate severing of the elements. The lines of severance are indicated in Figs. 1, 2 and 3 by dot-and-dash lines, and it will be noted that the trough 40 is preferably horizontal at the point of severance, this being a desirable condition for best cooperation with the punch subsequently functioning to sever the individual elements from the wire.

In the drawings it will be seen that the successive notches or serrations at the side edges of the wire are closely adjacent one another, and that the successive interlocking means or projections and recesses are closely adjacent one another, the spacing therebetween being only a fraction of the length of the elements.

As is explained in the co-pending application Serial Number 215,180 previously referred to, the embryo elements are preferably fed jaw first toward the tape, and are severed from the wire at or about the same time that they are secured to the tape. For this reason, the wire is rolled in such direction as to point the embryo elements head first, as is clearly shown in Figs. 1, 2 and 6. It necessarily follows that when the wire is drawn from reel 38, the embryo elements point jaw first. The apparatus for mounting the elements on the tape forms no part of the present invention, and need not be described in detail. It is schematically illustrated in Fig. 7, in which the wire 42 is fed jaw first from reel 38 to a mounting machine generally designated 44 wherein the elements are successively secured to an intermittently vertically moving tape, the finished tape carrying the fastener elements being indicated as leaving the machine at 46.

The machine is described in application Serial Number 215,180 previously referred to, but one change may be indicated. As described in said application, there is a web of waste or scrap material between the embryo elements, and the severing punch punches this material away from between the elements. No relative vertical displacement of the wire and element is needed. In the present arrangement, there is no waste or scrap material between the successive embryo elements, the severing operation being a shearing operation, and I therefore provide relative movement of the wire and the endmost element being severed therefrom. For convenience in attaching the endmost element to the tape, I prefer to move the wire rather than the element. Referring to Figs. 8 and 9, the endmost element 48 is shown adjacent the tape 50, said element being severed from the wire by a punch 52 which operates on the wire and cuts around the element. The element 48 rests upon and is held in position by a stationary support 54 whereas the wire 42 is depressed by punch 52, the movement of wire 42 being accommodated by a yieldable support or "spring pad" 56. The punch 52 is cut away at 53 for clearance. The clamping jaws are not shown, but are generally like those in application Serial No. 215,180 above referred to. They follow the punch 52 on each side of tape 50, and operate directly over the die 54 on which the endmost element rests.

I have so far described the invention in preferred form in accordance with which the embryo elements are rolled from a round wire. It is also possible, however, to utilize the main features of the invention while starting with other types of stock. For example, in Fig. 10 I show the manner in which strips of embryo elements may be formed from a large sheet 60. Strips 62 having the desired serrated or notched edges 64 are struck successively from the edge of the sheet by a suitable die working in a large press. The sheet 60 is, of course, intermittently advanced in the direction of the arrow 66.

It is important to observe that the successive strips 62, 68, 70, may themselves be struck from the sheet without scrap or waste metal, for the serrated edges of the successive strips mate with one another. If the notches or points of the successive strips are made symmetrical, the strips may be considered to face all in the same direction, but this is not at all necessary, and the notches may be made unsymmetrical in order to give the spread embryo jaws the most desirable outline. The only difference in such case is that alternate strips may be considered as facing in opposite directions. Thus, in strips 62 and 70 the embryo heads point toward the left, while in strip 68 the embryo heads point toward the right.

This result may be obtained while using a single punch or die having the outline of the strip 68, the sheet 60 then being advanced the distance of two strips for each operation of the press. Strip 68 is then formed directly beneath the punch and strip 62 is formed beyond the punch, two strips being cut for each operation of the punch.

Still another manner in which strips having the desired serrated edge may be formed, is illustrated in Fig. 11. In this case I begin with a wire of preferably rectangular cross-section, as shown in Fig. 12. The wire is run between pressure rolls 72 which function to indent or serrate the edges of the strip. The rolls have flanges 73 at each side to prevent spreading of the material sideways while the edges are being compressed by the rolls. A continuous strip of great length may be formed, the strip being reeled, if desired.

The strips of Figs. 10 and 11 may be provided with the desired projections and recesses, and may be severed into individual elements, in accordance with known methods unnecessary to outline here in detail. The formation of the head and recess is schematically illustrated in Fig. 13, in which the strip 74 is fed over spring pads 76. A press-operated punch 78 moves the strip 74 downwardly against the cooperating stationary die 80. The strip is, of course, intermittently fed longitudinally between successive operations of the punch 78. This feed is facilitated by the notching or serration of the strip which provides excellent surfaces against which the appropriate feed and positioning dogs may operate.

The severance of the wire into individual elements is schematically illustrated in Fig. 14, in which it will be seen that a punch 88 cuts the strip 86 free from the endmost element 84. The punch works against a spring pad 90, and is cut away for clearance at 92. The shearing action is against stationary die 94. The end element 84 is held by a spring pressed plunger 82 which reciprocates with the punch 88, in known fashion. It is a simple matter to sever the elements from the strip when dealing with loose elements which are to be subsequently tumbled, hoppered, and so on. If the elements are to be secured directly to the tape as they are severed from the strip, the separation may be performed as was explained in connection with Figs. 8 and 9.

It will be understood by those skilled in the art that the operations of Figs. 13 and 14 need not be performed in separate machines, and in fact, the punches 78 and 88 may be mounted directly on a single press for simultaneous movement.

It will also be understood that it is not necessary within the scope of the present invention to form the heads after forming the serrated strips. It is possible for example, when cutting strips from a sheet as shown in Fig. 10, to form the heads and recesses in the sheet as the sheet is fed through the press, so that the strips cut from the sheet are characterized not only by the serrated edges, but also by heads and recesses. In such case the only operation needed to complete the elements is to sever the strip into individual elements, this being done all without scrap or waste, as has been previously described.

It is believed that the invention as well as the many advantages thereof, will be fully understood from the foregoing description. The elements are formed without substantial scrap or waste material, while starting with raw stock in common, inexpensive form, and while forming the embryo elements in a continuous strip or wire.

It will be apparent that while I have shown and described my invention in preferred forms, many changes and modifications may be made without departing from the spirit of the invention defined in the following claims.

I claim:

1. A step product used in the manufacture of slide fastener elements, said step product comprising a single integral strip of embryo fastener elements each having embryo spread jaws, the head of one element being located between the embryo spread jaws of the next element, said head filling the space between said embryo spread jaws, the exterior edges of the strip being notched or serrated to conform to the outer ends of the embryo spread jaws, whereby the elements may be formed from the strip without substantial waste or scrap material.

2. A step product used in the manufacture of slide fastener elements, said step product comprising a flattened strip of metal having closely spaced interlocking means at the top and bottom, the exterior edges of the strip having closely spaced notches or serrations to conform to the outer ends of embryo spread jaws, said spacing being only a fraction of the length of the elements, the strip providing metal for a series of embryo fastener elements with the embryo head of one embryo element nested within and filling the space between the embyro spread jaws of the next embryo element, whereby the elements may be formed from the strip without substantial waste or scrap material.

3. An interlockable element for a slide fastener, said element comprising a head and spread jaws connected thereto, the configuration of said head when viewed in plan being such as to conform to and fit fully within the space between the jaws, said jaws having diverging outer sides adapted to be brought into substantially parallel relation when the jaws are closed.

4. An interlockable element for a slide fastener, said element comprising a head and spread jaws connected thereto, said head being formed on opposite sides with a projection and a recess, the configuration of said head when viewed in plan being such as to conform to and fit fully within the space between the jaws, said jaws having diverging outer sides adapted to be brought into substantially parallel relation when the jaws are closed, and having converging ends

which are substantially perpendicular to the sides.

5. An interlockable element for a slide fastener, said element comprising a head and spread jaws connected thereto, said head being formed with interlocking means, and said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough and so shaped that the material removed from between said jaws will itself constitute a head like the head of the element, said jaws having ends converging at such an angle that when the jaws are closed on a tape the ends come substantially perpendicular to the tape, the part just inside the ends being substantially perpendicular to the ends in order to form a broad bearing surface on the tape when the jaws are closed.

6. An interlockable element for a slide fastener, said element comprising a head and spread jaws connected thereto, said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough to receive the entire head of an identical element, said jaws being so shaped that when closed the outer edges come into substantially parallel relationship.

7. An interlockable element for a slide fastener, said element comprising a head and spread jaws connected thereto, said head being formed with interlocking means, and said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough and so shaped that the material removed from between said jaws will itself constitute a head like the head of the element, said jaws having ends converging at such an angle that when the jaws are closed on a tape the ends come substantially perpendicular to the tape for cooperation with a slider.

8. An interlockable element for a slide fastener, said element comprising a head and spread jaws connected thereto, said head being formed with interlocking means, and said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough and so shaped that the material removed from between said jaws will itself constitute a head like the head of the element, said jaws having ends arranged substantially perpendicular to the outer sides of the jaws, said ends being of such dimension that when closed against a tape the sides of the jaws are brought into substantially parallel relation while the ends form substantially perpendicular shoulders for cooperation with a slider.

9. In the manufacture of slide fastener elements, the method which includes forming a continuous strip of metal having notched or serrated edges conforming to the outer ends of embryo spread jaws, said strip comprising a series of embryo elements with the embryo head of one formed within and filling the space within the embryo spread jaws of the next element, and severing the elements without substantial scrap or waste.

10. In the manufacture of slide fastener elements, the method which includes forming a continuous strip of metal to have notched or serrated edges conforming to the outer ends of embryo spread jaws, and a series of interlocking means, the successive notches being closely adjacent one another and the successive interlocking means being closely adjacent one another, the spacing therebetween being only a fraction of the length of the elements and corresponding to the spacing of a series of embryo elements with the embryo head of one embryo nested fully within the filling the space within the spread embryo jaws of the next embryo element, and severing the strip on an outline such as to define the elements without substantial scrap or waste.

11. In the manufacture of slide fastener elements, the method which includes treating a wire to give the same serrated or notched edges conforming to the outer ends of the embryo spread jaws of a series of embryo fastener elements, and severing individual fastener elements from the wire by means of a punch or other severing means which functions to outline the head of the element, the head of each element being formed between and filling the space between the embryo spread jaws of the next element, whereby the elements are formed without substantial scrap or waste.

12. In the manufacture of slide fastener elements, the method which includes pressing a round wire between forming devices to squeeze the same or deform the same into a wire having serrated or notched edges and a series of interlockable projections and recesses on opposite sides of the wire, the embryo head of each element being formed between and filling the space between the embryo spread jaws of the next element, and finally forming the individual elements by severing the endmost element from the embryo jaws of the next succeeding element, whereby said elements are formed without substantial scrap or waste.

13. In the manufacture of slide fastener elements, the method which includes pressing a round wire between forming devices to squeeze and deform the same into a wire having serrated or notched edges, and a series of interlockable projections and recesses on opposite sides of the wire, the successive serrations geing closely adjacent one another and the successive interlockable means being closely adjacent one another, the spacing therebetween being only a fraction of the length of the elements and corresponding to the spacing of a series of embryo fastener elements with the embryo head of each embryo element nested fully within and filling the space between the embryo spread jaws of the next embryo element, and finally forming the individual elements by severing the strip on an outline such as to define the elements without substantial scrap or waste.

14. In the manufacture of slide fastener elements, the method which includes rolling a continuous wire between appropriately shaped pressure rolls to squeeze and deform the wire so as to give the same serrated or notched edges conforming to the outer ends of the embryo spread jaws of a series of embryo fastener elements, and severing individual fastener elements from the wire by means of a punch or other severing means which functions to outline the head of the element, the embryo head of each element being formed between and substantially filling the space between the embryo spread jaws of the next element, whereby the elements are formed without substantial scrap or waste.

15. In the manufacture of slide fastener elements, the method which includes rolling a wire between appropriately recessed pressure rolls to squeeze the wire and deform the same into a wire having serrated or notched edges and a series of interlockable projections and recesses on opposite sides of the wire, the spacing of the serrations and of the interlockable means being so close as to correspond to a series of embryo fastener elements only if the embryo head of each

embryo element is nested fully within and substantially fills the space between the embryo spread jaws of the next embryo element, and finally forming the individual elements by severing the strip on an outline such as to define the elements without substantial scrap or waste.

16. In the manufacture of slide fastener elements, the method which includes pressing a round wire between forming devices to squeeze the same or deform the same into a wire having serrated or notched edges and a series of interlockable projections and recesses on opposite sides of the wire, and a trough or scoring outlining the heads of the elements, the embryo head of each element being formed between and filling the space between the embryo spread jaws of the next element, and finally forming the individual elements by severing the elements at the scoring without substantial scrap or waste.

17. In the manufacture of slide fastener elements, the method which includes forming a continuous strip of metal having notched or serrated edges conforming to the outer ends of embryo spread jaws, said strip comprising a series of embryo elements with the embryo head of one formed within and filling the space within the embryo spread jaws of the next element, and successively severing the elements by separating the head of the endmost element from between the embryo jaws of the next succeeding element by punching the strip including said embryo jaws away from the endmost element, whereby said elements are formed without substantial scrap or waste.

18. In the manufacture of slide fastener elements, the method which includes cutting successive strips from a sheet of material, each of said strips having notched or serrated edges conforming to the outer ends of the spread jaws of successive fastener elements, the successive strips mating together with the serrated edge of one fitting into the serrated edge of the next, whereby said strips are cut from the sheet without substantial scrap or waste, and severing each strip into individual elements.

19. In the manufacture of slide fastener elements, the method which includes cutting successive strips from a sheet of material, each of said strips having notched or serrated edges conforming to the outer ends of the spread jaws of successive fastener elements, and severing the individual elements by means of a punch or cutting means which outlines the head of the element, said head conforming to and fitting within and substantially filling the space between the spread jaws of the next element, whereby the individual elements are formed from each of the serrated strips without substantial scrap or waste.

20. In the manufacture of slide fastener elements, the method which includes cutting successive strips from a sheet of material, each of said strips having notched or serrated edges conforming to the outer ends of the spread jaws of successive fastener elements, the successive strips mating together with the serrated edge of one fitting into the serrated edge of the next, whereby said strips are cut from the sheet without substantial scrap or waste, and severing the individual elements by means of a punch or cutting means which outlines the head of the element, said head conforming to and fitting within and substantially filling the space between the spread jaws of the next element, whereby the individual elements are formed from each of the serrated strips without substantial scrap or waste.

21. In the manufacture of slide fasteners, the method which includes forming a continuous strip of metal having notched or serrated edges conforming to the outer ends of embryo spread jaws, said strip comprising a series of embryo elements with the embryo head of one formed within and filling the space within the embryo spread jaws of the next element, feeding the strip longitudinally with the embryo elements pointing jaw first toward a transversely extending tape until the jaws at the end of the strip are astride the tape, thereupon punching the strip including the embryo jaws of the second element away from the endmost element in a direction parallel to the direction of the tape, clamping the jaws of the endmost element on the tape, feeding the tape in longitudinal direction, again feeding the strip to bring the next jaws astride the tape, and so on.

22. In the manufacture of slide fasteners, the method which includes forming a continuous strip of metal having successive closely adjacent projections on one side and having successive closely adjacent recesses on the opposite side, the spacing between the successive projections and the successive recesses being only a fraction of the length of the elements to be formed therefrom and corresponding to the spacing of a series of embryo fastener elements with the embryo head of each element nested fully within and filling the space between the embryo spread jaws of the next embryo element, feeding the strip longitudinally with the embryo elements pointing jaw first toward a transversely extending tape until the jaws at the end of the strip are astride the tape, thereupon punching the strip including the embryo jaws of the second element away from the endmost element in a direction parallel to the direction of the tape, clamping the jaws of the endmost element on the tape, feeding the tape in longitudinal direction, again feeding the strip to bring the next jaws astride the tape, and so on.

23. A step product used in the manufacture of slide fastener elements, said step product comprising a flattened strip of metal having closely spaced interlocking means at the top and bottom, the exterior edges of the strip having closely spaced notched or serrations to conform to the outer ends of embryo spread jaws, said spacing being only a fraction of the length of the elements, the strip providing metal for a series of embryo fastener elements with the embryo head of one embryo element nested within and filling the space between the embryo spread jaws of the next embryo element, whereby the elements may be formed from the strip without substantial waste or scrap material, the interlocking means comprising closely spaced projections at the top of the strip and closely spaced recesses at the bottom of the strip, the top of the strip having troughs or indentations bordering part of the periphery of the projections at the top of the strip.

FREDERICK ULRICH.

CERTIFICATE OF CORRECTION.

Patent No. 2,221,740. November 12, 1940.

FREDERICK ULRICH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 75, claim 10, after "embryo" second occurrence, insert --element--; and second column, line 1, same claim, for "the" first occurrence, read --and--; line 38, for "geing" read --being--; page 5, second column, line 54, for "notched" read --notches--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of December, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

DISCLAIMER

2,221,740.—*Frederick Ulrich*, Bayonne, N. J. Manufacture of Slide Fastener Elements. Patent dated Nov. 12, 1940. Disclaimer filed Aug. 8, 1947, by the assignee, *Conmar Products Corporation*.

Hereby enters this disclaimer to claims 3, 5, 6, 7, and 8.

[*Official Gazette September 23, 1947.*]

DEFENDANT'S EXHIBIT "E"

G. Sundback Patent No. 1,331,884

Filed Mar. 16, 1916 Patented Feb. 24, 1920

1724

G. SUNDBACK.

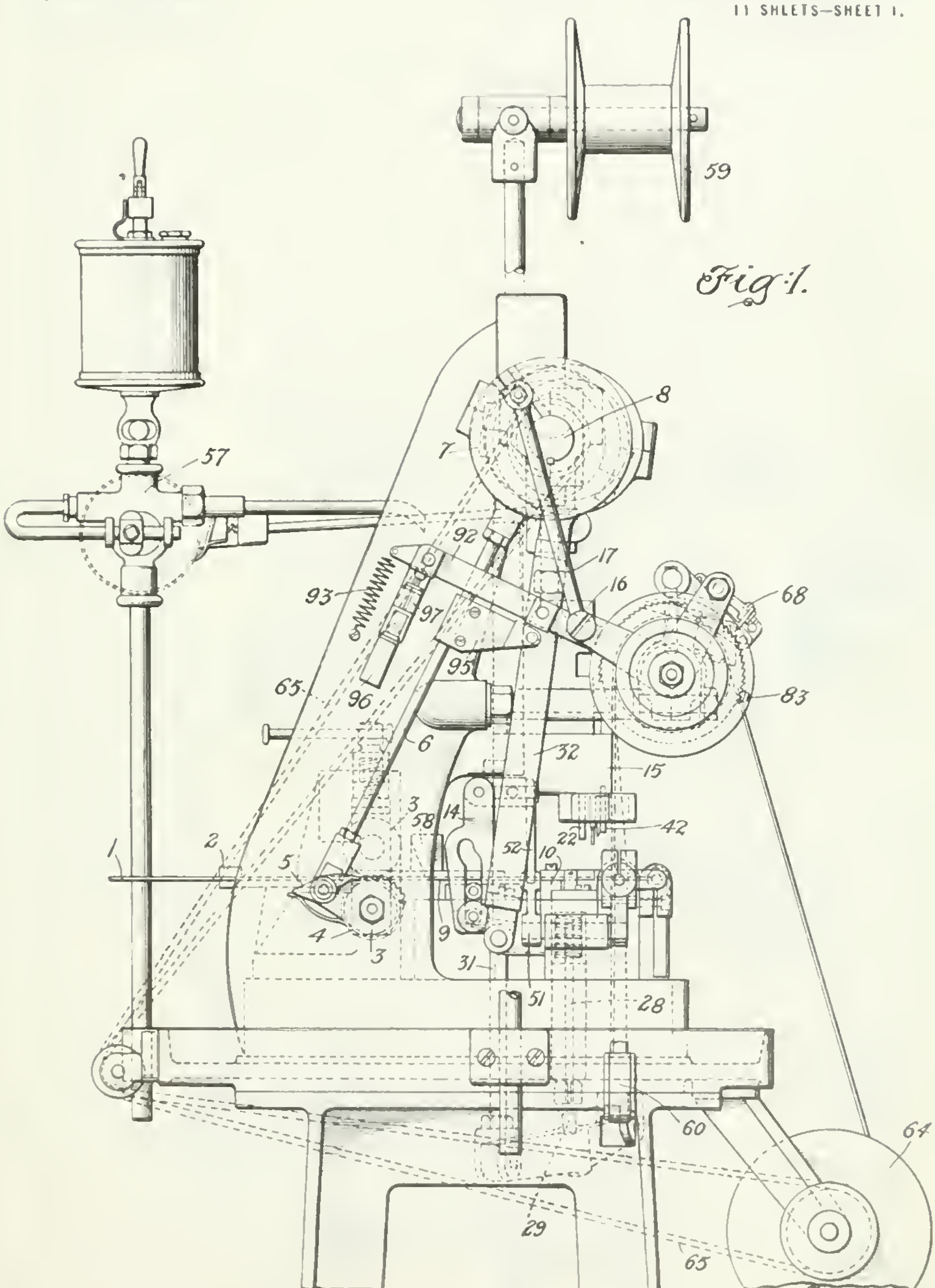
SHEET METAL FORMING AND SETTING MACHINE.

APPLICATION FILED MAR. 16, 1916.

1,331,884.

Patented Feb. 24, 1920.

11 SHEETS—SHEET 1.



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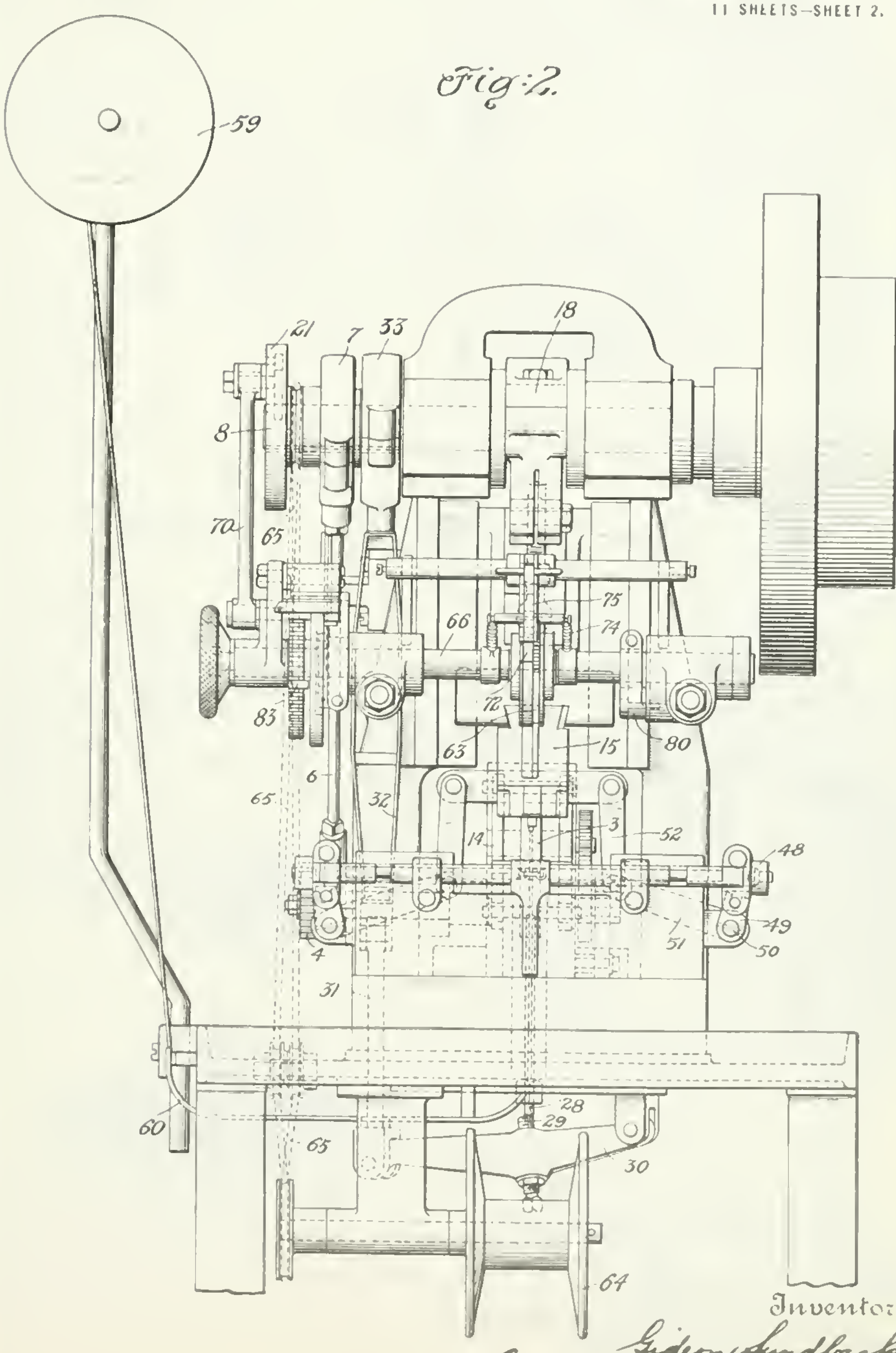
SHEET METAL FORMING AND SETTING MACHINE.
APPLICATION FILED MAR. 16, 1916.

1,331,884. Patented Feb. 24, 1920.

11 SHEETS—SHEET 2.

Fig. 2.



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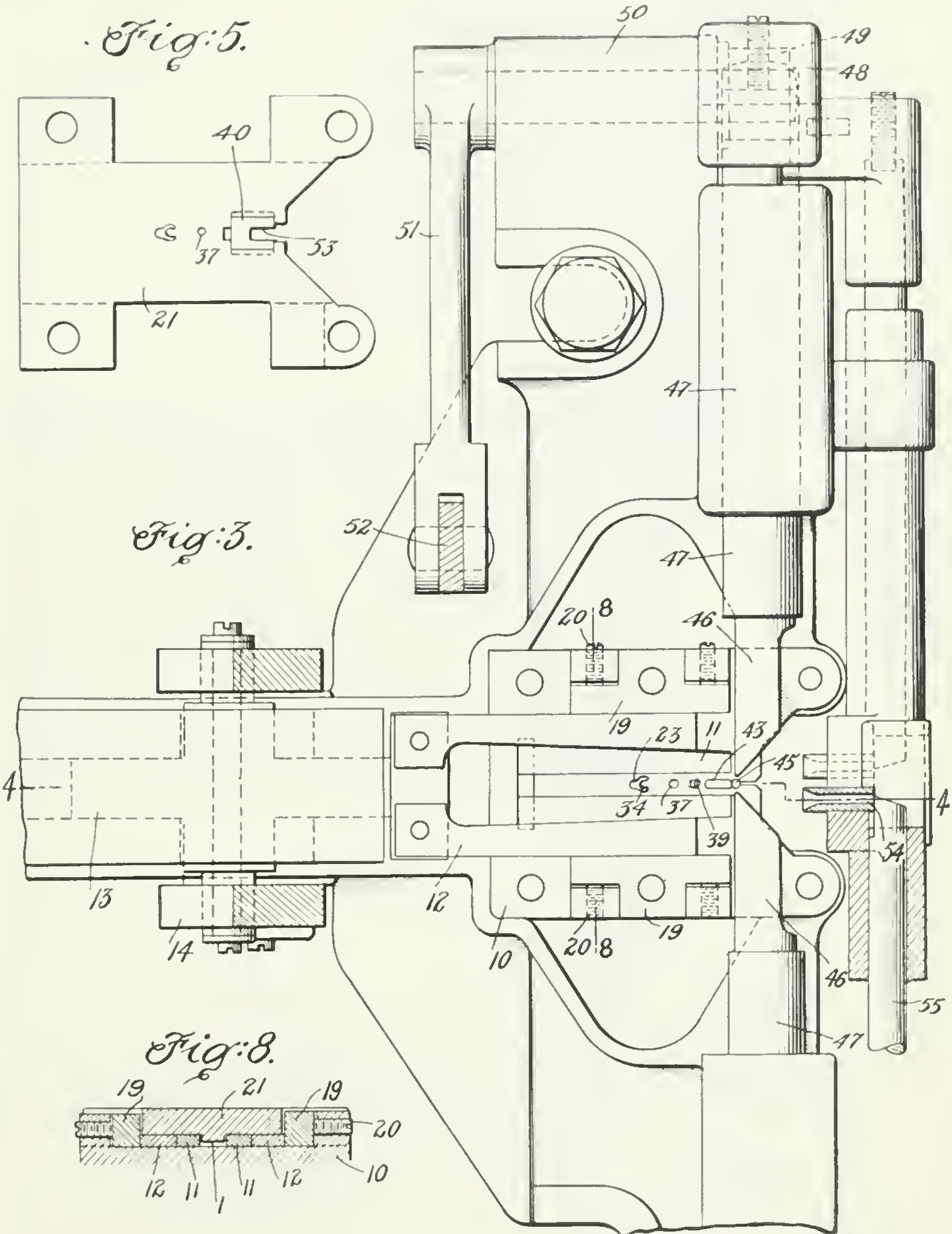
11 SHEETS—SHEET 3.

Fig:5.



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11 SHEETS—SHEET 4.

Fig:4.

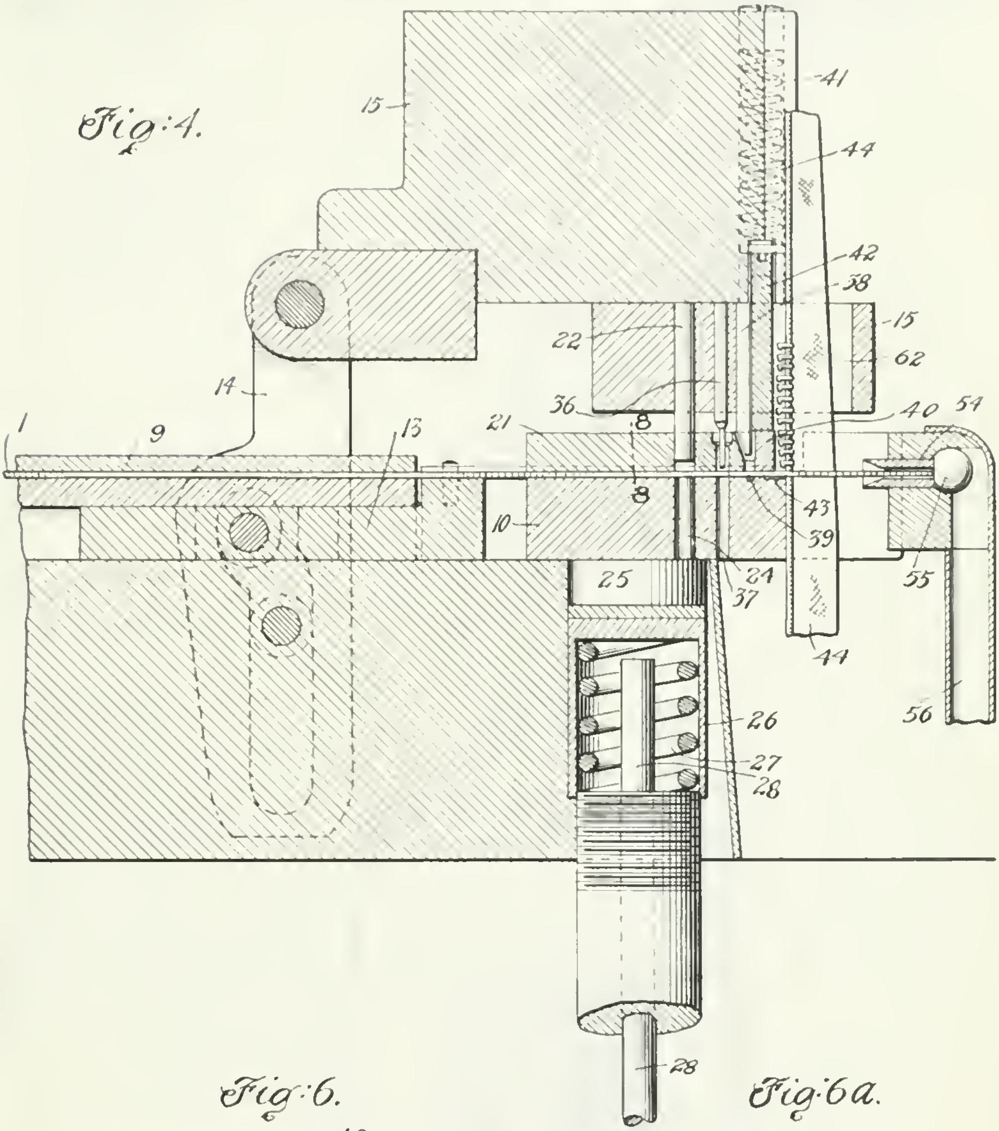

Fig:6.

Fig:6a.

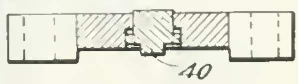

Fig:7

Fig:7a.

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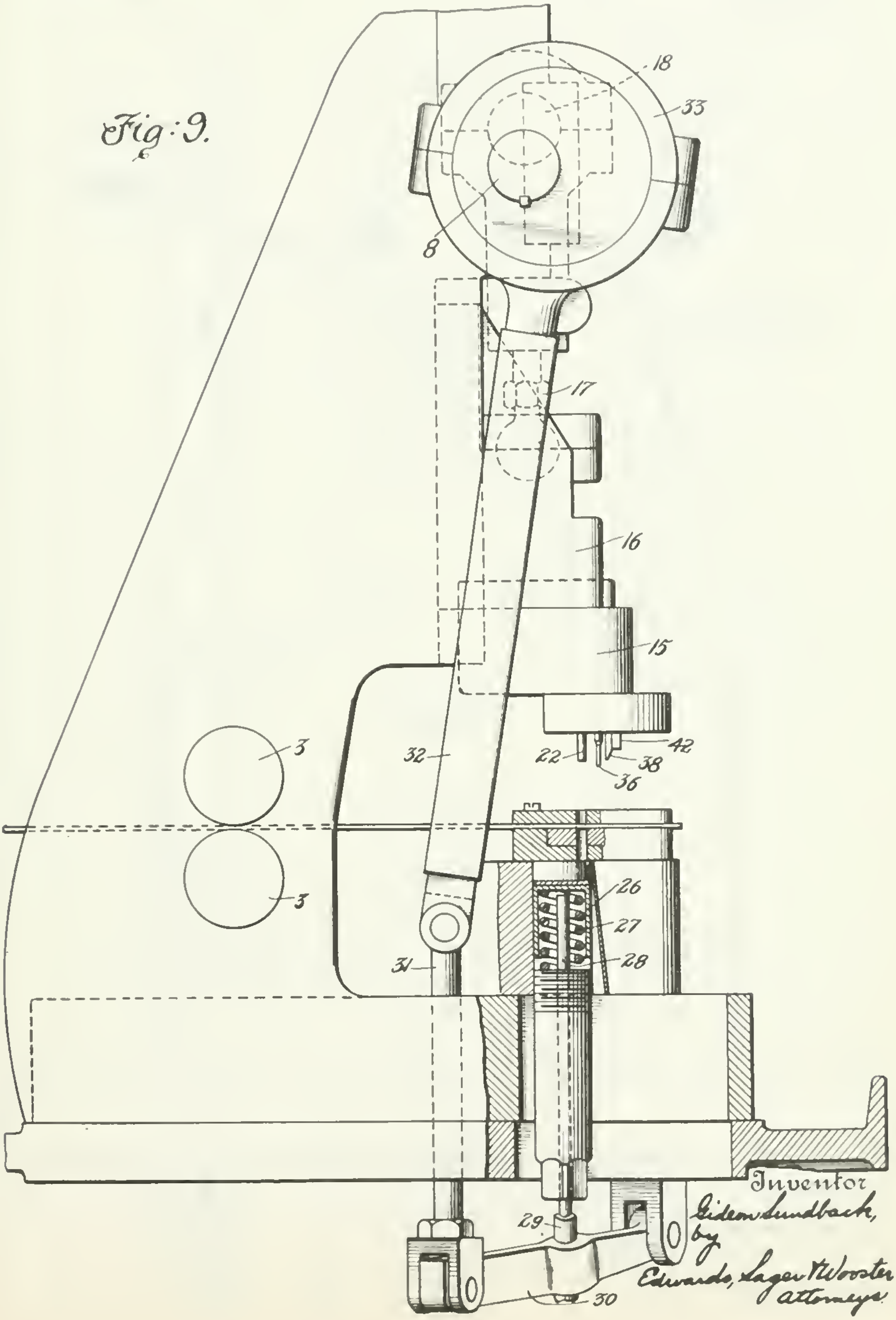
11 SHEETS—SHEET 5.

Fig: 9.



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11 SHEETS—SHEET 6.

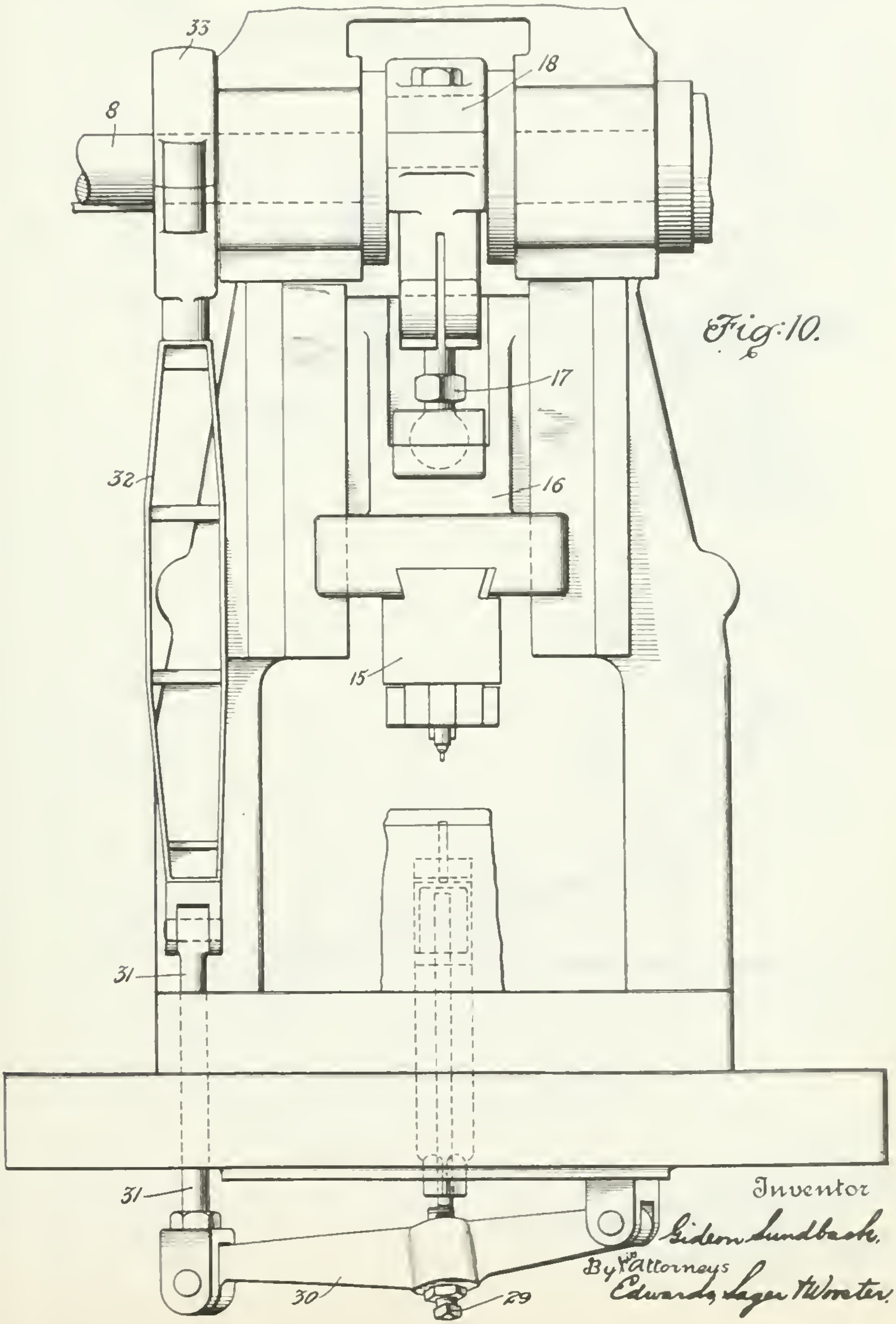

Fig. 10.

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11 SHEETS—SHEET 7.

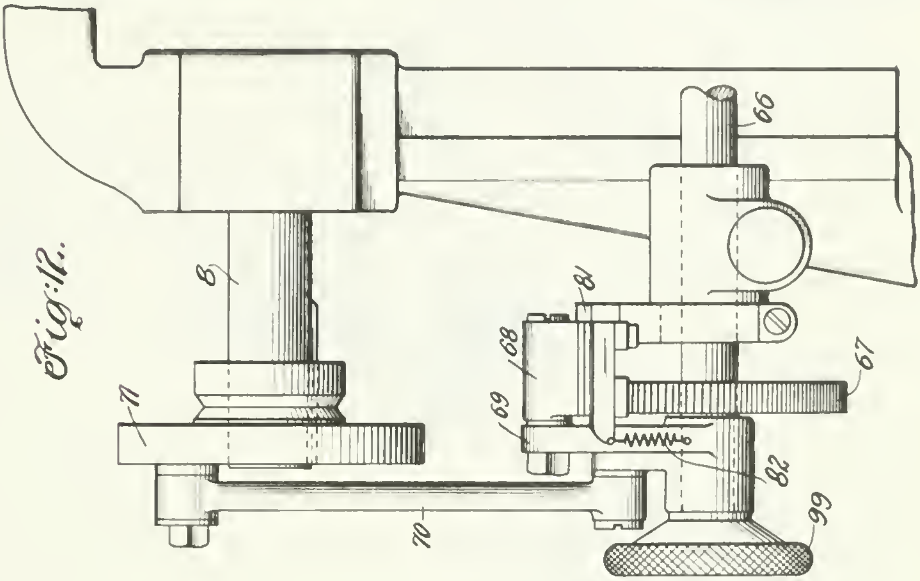

Fig: 12.

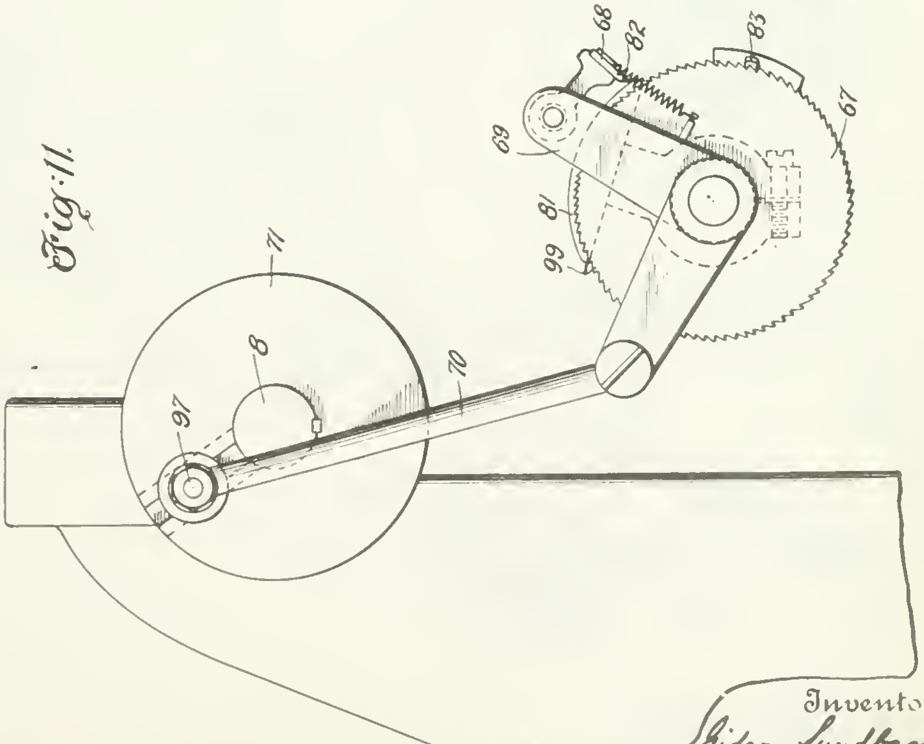

Fig: 11.

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1,331,884. Patented Feb. 24, 1920.

11 SHEETS—SHEET 8.

Fig: 14.

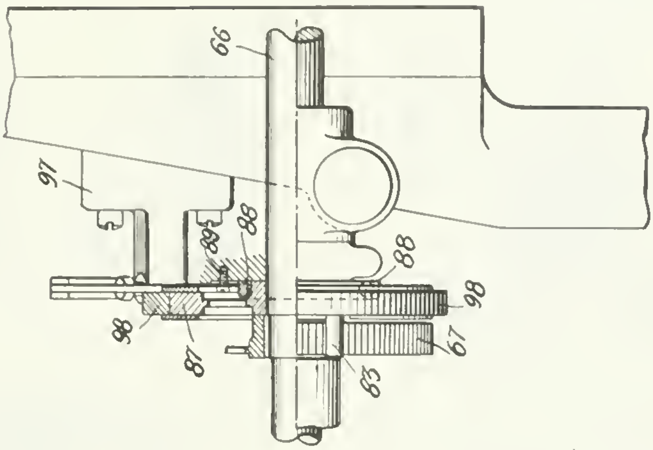
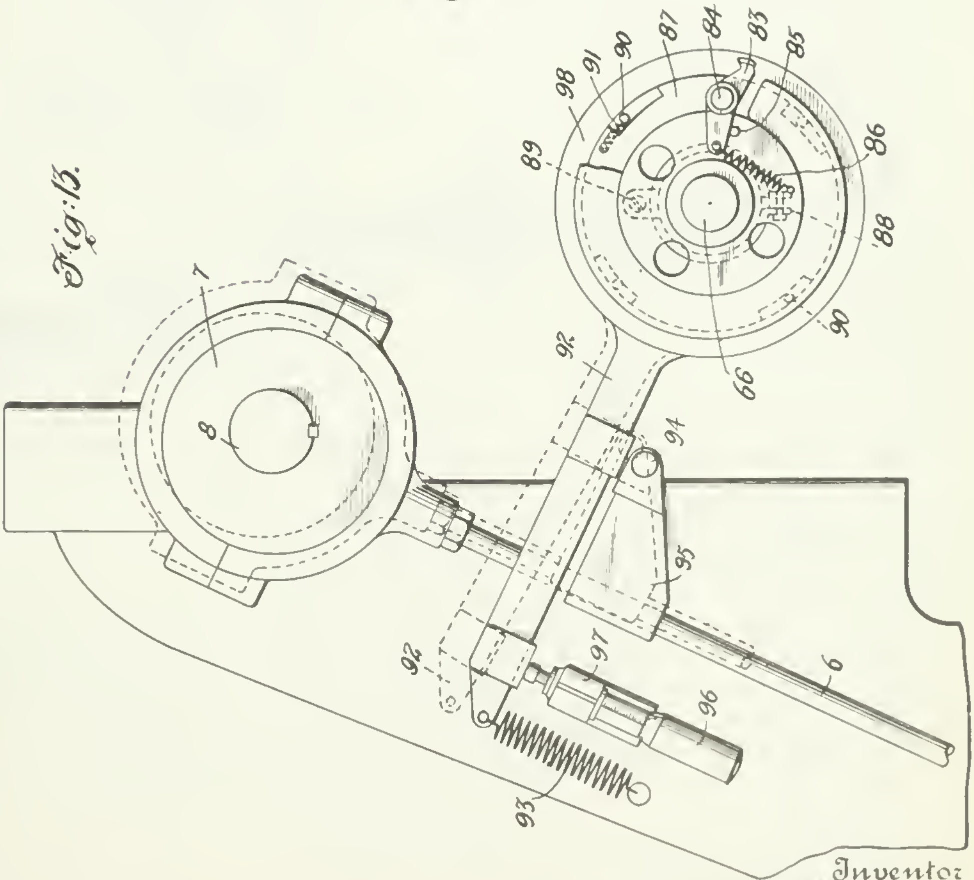


Fig: 15.



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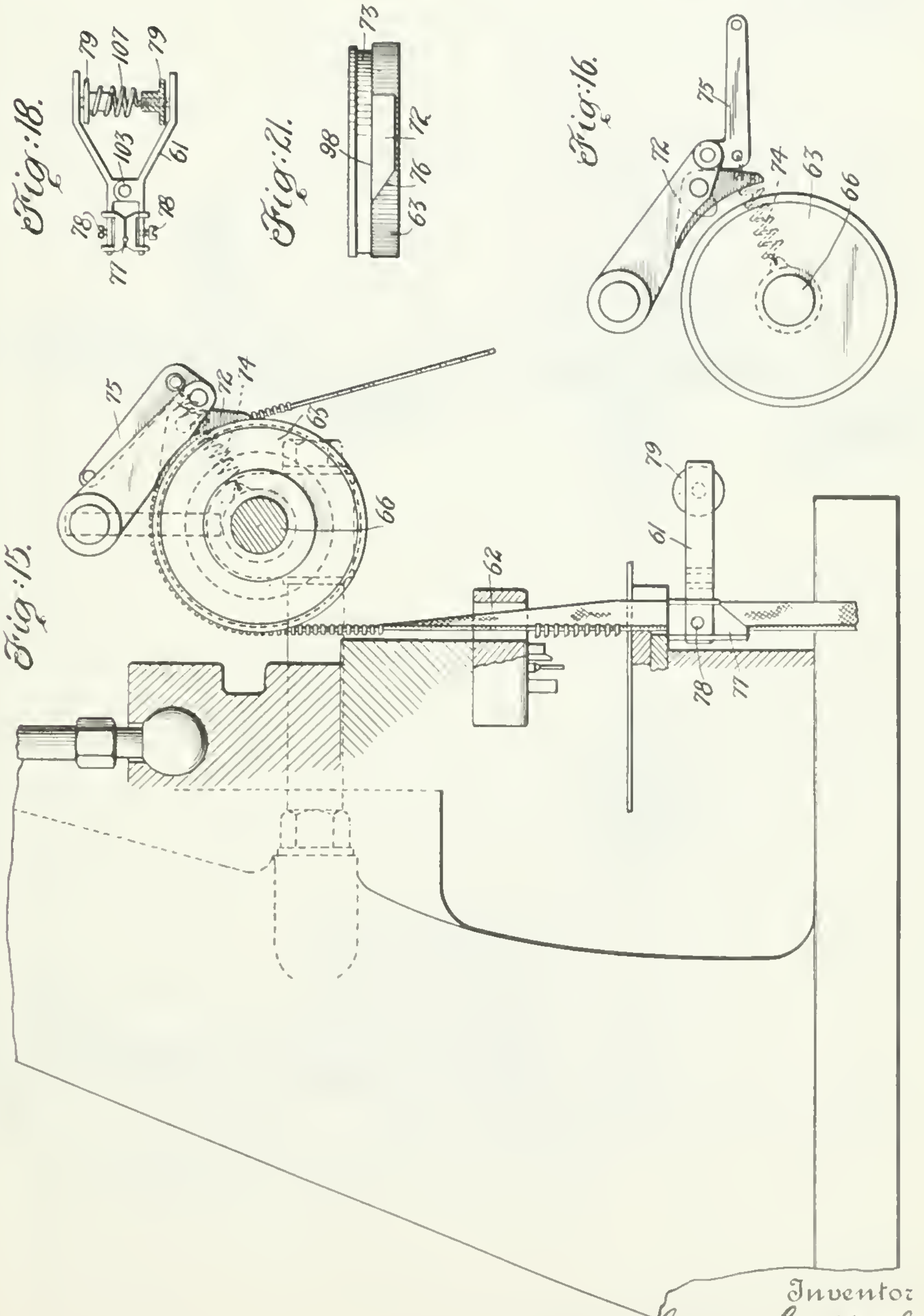
11 SHEETS—SHEET 9.



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11 SHEETS—SHEET 10.

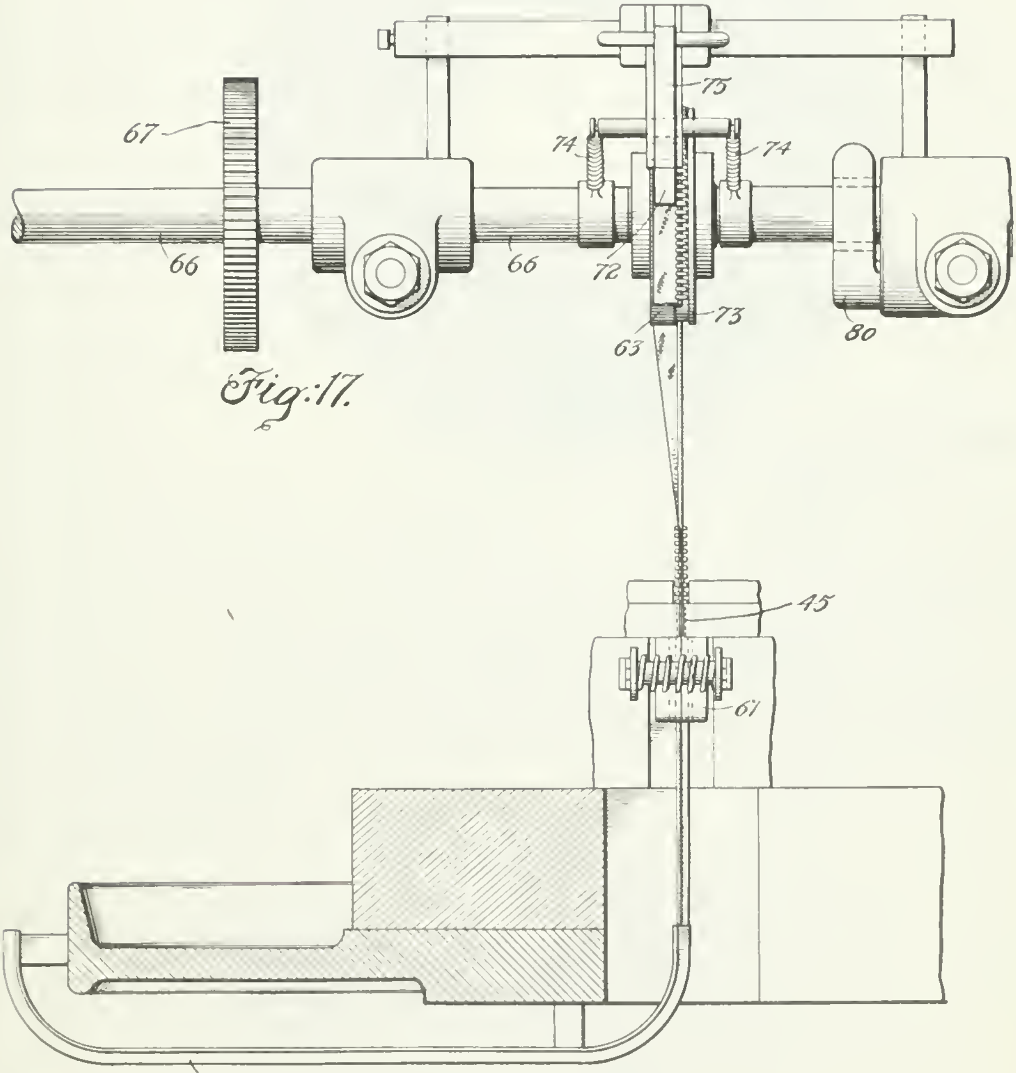

Fig:17.

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11 SHEETS—SHEET 11.

Fig: 22.

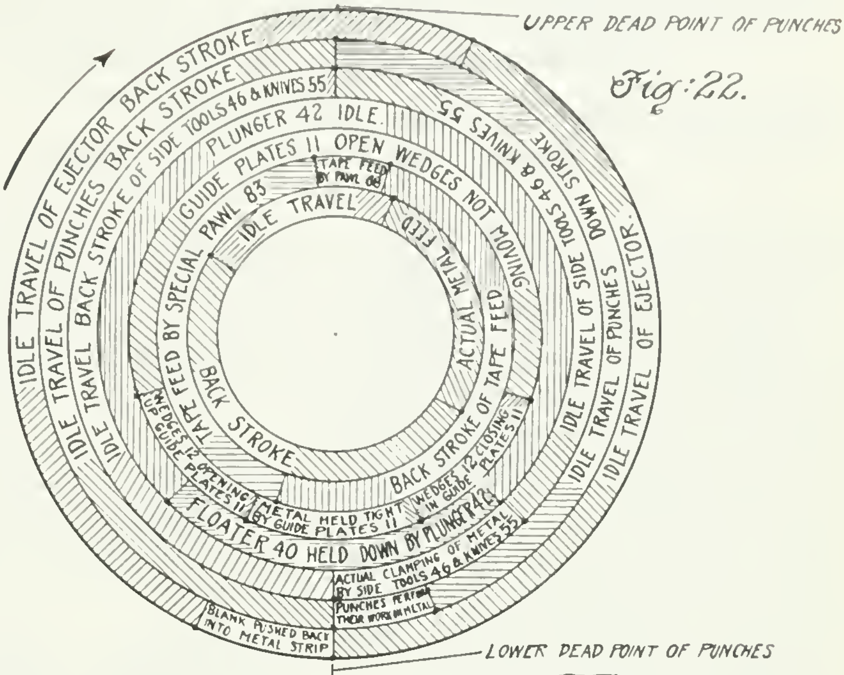


Fig: 19.

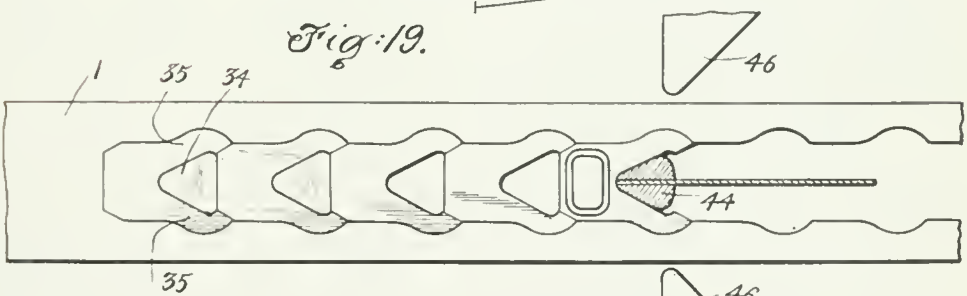
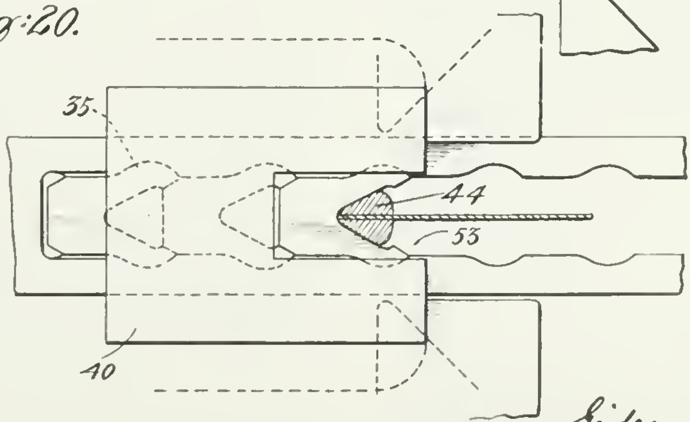


Fig: 20.



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UNITED STATES PATENT OFFICE.

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SHEET-METAL FORMING AND SETTING MACHINE.

1,331,884. Specification of Letters Patent. Patented Feb. 24, 1920.

Application filed March 16, 1916. Serial No. 84,550.

To all whom it may concern:

Be it known that I, GIDEON SUNDBACK, a subject of the King of Sweden, residing at Meadville, in the county of Crawford and State of Pennsylvania, have invented certain new and useful Improvements in Sheet-Metal Forming and Setting Machines, of which the following is a full, clear, and exact specification.

This invention relates to a machine for forming and setting metal punchings, and has particular reference to a special form of power press with automatic blank feeding means whereby punchings are formed from a strip blank and set on a carrying element.

The machine illustrated herein is intended for forming the fastener members shown in my Patent 1,219,881, dated March 20, 1917, and affixing them to the corded fabric tape shown therein. The fastener members consist of separated jaws and an interlocking member having a recess on one side and a head on the other, these respective recesses and heads being arranged on a pair of tapes so as to alternately interlock.

The machine of the present invention has for its object to form and set these fastener members on the tape with one handling of the material, and a further object of the invention is to enable the machine to automatically set these interlocking members in separated groups of a predetermined number each, so that the tape can be cut apart to provide fasteners of desired length.

The present invention is not limited in its broad aspects to the production of the particular fastener members referred to, nor to the setting of such members on tapes, but is of general application wherever it is desired to automatically and cheaply form large numbers of like parts, and to set them on a suitable carrier element.

A feature of novelty in the invention resides in the construction whereby the punching is completely separated from the blank and is then immediately replaced therein so that it can be further fed for the subsequent operations, of shaping and setting, or the latter alone, by the blank feed without applying the setting tools directly to the punching. Owing to the necessity of making the fastener members as nearly alike as possible, in order that they will lock and unlock properly when set on the tapes, it is necessary to have the utmost accuracy in the shaping and setting operations subsequently to the punching out from the blank, and by causing the punching to be replaced in the blank and controlled thereby, it is possible to apply pressure to the punching through the blank so as to hold the punching firmly during the shaping operation, and then by a further side punching operation through the blank, the jaws are firmly set on the carrier element or tape without leaving any tool marks upon the jaw members themselves. After the jaw members are set, the residue of the blank is fed out in one place and the carrier element having the jaw members affixed thereto is fed out in another direction. The avoidance of tool marks on the jaw members themselves is of decided advantage, since it cheapens the subsequent finishing required in the finished fastener.

In carrying out the invention, various novel combinations and sub-combinations in the controlling, feeding, punching, pressing and setting mechanisms have been secured, all of which will be more fully understood in connection with the description of the accompanying drawings, wherein

Figure 1 is a side elevation of a machine;

Fig. 2 is a front elevation;

Fig. 3 is a plan view showing the die and die block;

Fig. 4 is a vertical section on the line 4—4 of Fig. 3;

Figs. 5, 6, 6^a, 7 and 7^a are details of the top or stripper plate, which holds the blank down on the dies;

Fig. 8 is a cross-section on the line 8—8 of Fig. 3 showing the passageway for the blank;

Figs. 9 and 10 are side and front elevations, respectively, showing the movements by which the punching is pressed back into the blank as the punchers are withdrawn;

Fig. 11 is a side view of the tape feeding mechanism;

Fig. 12 is a front view of the tape feeding mechanism;

Fig. 13 is a side elevation showing a further detail of the tape feed;

Fig. 14 is a further detail front view;

Figs. 15 and 16 are additional detail side views of the tape feed;

Fig. 17 is a front view of Fig. 15;

Fig. 18 is a plan view of the tape tension;

Fig. 19 is a plan view on an enlarged scale showing the blank and the punchings in different stages of progress;

Fig. 20 is an enlarged top view showing the blank under a yielding presser plate permitting the punchings to be fed forward with the blank without disengagement;

Fig. 21 shows an additional detail of the tape feed, and

Fig. 22 is a timing diagram.

1 represents a metal blank, which is preferably in the form of a flat strip, and is fed into the machine from the rear toward the front. The machine is applicable to separate blanks as well as to a continuous strip, but in making very small fasteners such as herein shown, which are approximately one-eighth inch long and one-sixteenth inch wide when fastened and applied to the tape, it is preferable to employ a strip. Referring to Figs. 1 and 4, the blank 1 enters guide 2 and passes through feed rolls 3, 3, then through guide 9 to the die unit 10, and between the side guide plate 11 (see Figs. 3 and 8). The guide plates 11 are controlled by wedges 12 (see Figs. 3 and 8). The wedges 12 are operated through a slide 13 (see Figs. 3 and 4), and cam plates 14 by the punch head 15, held in the slide 16 (see Figs. 9 and 10) and moved up and down through connecting rod 17 and crank 18 on the main shaft 8. The feed rolls 3, 3 are operated by ratchet 4, pawl 5 and connecting rod 6 from eccentric 7 mounted on the main shaft 8 (see Figs. 1 and 2).

22 is the blanking punch which punches out the entire member and the piece 34 into die 23 (see Figs. 3 and 4). As the punch 22 draws out of the die, the plunger 2' carried by plunger holder 25 and sleeve 26, is actuated by spring 27 to press the punchings back into original place in the metal blank 1. The piece 34 (Fig. 19) lies in the blank between the jaws 35 of the punching. This scrap piece 34 is pushed out of the blank 1 by punch 36 (see Fig. 4) into the hole 37 in die unit 10. The next step is to press or form the punching in its final form ready to be clamped on the tape, and this is effected by punch 38 and recess 39 in die unit 10 (Figs. 4 and 5).

On the down stroke of slide 16, as the punches are nearing the blank, the cam plates 14 (see Fig. 3) draw the wedges 12 toward the back, pressing the guide plates 11 toward each other with the blank in between, thus holding the blank firmly in place until released by the forward movement of the wedges 12 on the up stroke of slide 16. Figs. 3 and 4 show the position at the moment the clamping movement of the guide plates 11 has been effected. To allow for wear and variation in the width of the blank 1, the space between the guide plates 11 is adjustable by blocks 19 and set screws 20 (see Fig. 3).

The function of the guide plates 11 is of vital importance. At the time of punching, the two plates hold the material firmly against spreading and distortion either of the punching or of the blank. This enables the subsequent operations on the punching to be controlled through the blank, and insures such perfect shape of the finished punchings and correct positioning thereof in the dies, as to produce a highly uniform and symmetrical fastener member and product. When the guide plates 11 draw tight around the blank 1, they not only bring the blank into a central position over the dies, but force the punchings, if they should happen to get out of place, into correct position lengthwise of the blank. The guide plates spread apart during the feed and allow an easy and free movement of the blank. It also allows the interlocking or projecting end of the fastener punching to lift up out of the recess 39 (see Fig. 4) in die unit 10 after the impression of punch 38.

At this time the blank 1, after reaching die unit 10 is confined between die unit 10 on the bottom and stripper plate 21 on the top (see Fig. 8).

In order to avoid reliance solely upon spring 27 to press the punching back into its original place in the blank as punch 22 withdraws, a positive movement is provided. Rod 28 in addition to spring 27 exerts pressure on sleeve 26 thus forcing the punching into its place in the blank. Rod 28 is acted upon through screw 29 in lever 30 (see Figs. 9 and 10) and connecting links 31, 32 from eccentric 33 on main shaft 8. Upon the return of the punching to its proper place in the blank and with the coöperation of the side guides 11, top of die unit 10 and stripper plate 21, the punching can now be fed forward by the blank feed rolls 3, 3, without any danger of becoming displaced. A displacement at this time would cause much trouble, because of the extreme accuracy required in the finished fastener members of such small dimensions.

The blank after return of the punching is fed forward as above stated so that the scrap piece 34 can be pushed out of the blank 1 by punch 36, and then the punching is pressed into recess 39 in die unit 10 by punch 38 to form the interlocking recess and projection. At this time, it is necessary to hold the blank and punching down onto the face of the die unit 10 and also to hold it against lateral spreading by contraction of the side guides 11. The stripper plate 21 partly performs this function, but in addition there is provided a yielding presser or floater 40 (see Figs. 5, 6, 7, 20) which is mounted in stripper plate 21 and bears down on the jaws 35 of the punching, and on the blank 1, by means of springs 41 (see Fig. 4) and plunger 42. This plunger 42 is timed and adjusted to commence pressure as soon as the forward movement of the blank stops, and can be adjusted to exert a positive pressure upon the blank and punching by contacting with a lug on punch block 15 when the punches are in their lowest position. Thus the blank and punching are firmly held in position while the transversely elongated recess and projection are formed by the punch 38 and die recess 39.

When the blank 1, still carrying the fastener member, which is now finished and ready to be pressed on the tape, is again fed forward, the floater or presser 40 yields upwardly so as to permit the projection of the fastener member to lift out of the die recess 39 so that it can be carried forward into recess 43 (Figs. 3 and 4) ready to be set. To prevent the fastener member punching from lifting out of the blank 1 altogether, the lift of the yielding presser 40 is limited as shown in Fig. 7ª. Figs. 6 and 6ª show the presser 40 at its lowest position and Figs. 7 and 7ª show it at its highest position.

The finished punching is now carried forward by the next motions of the feed rolls 3, 3 until it reaches the position where the jaws 35 straddle the corded edge of the tape 44 (see Fig. 19). The tape 44 is fed intermittently upward and at right angles to the blank feed through the hole and slot 45 (see Figs. 3 and 4) in die unit 10. In this position the jaws 35 are clamped around the corded edge of the tape by side tools 46 (see Figs. 3 and 19) which simultaneously press toward each other on the outside of the blank 1, while the formed jaw nember is being held between the top of the die unit 10 and the resilient presser 40 (see Figs. 3 and 4). Each of the side tools 46, which set the jaw members on the carrier element, tape, or stringer, is held in and moved through the slide 47 which is connected at 48 by lever 49, rock shaft 50, arm 51, and link 52 to punch block 15 (see Fig. 2). When the clamping movement is completed, the tape feeds up and lifts the jaw member clamped to its corded edge, out of the residue of the blank 1, the tape and attached jaw member passing through slot 53 in floater 40 (see Fig. 5). There now remains of the blank 1 only the two edges, which are fed through the tubes 54 (see Figs. 3 and 4) and cut into small pieces by knives 55 connected to the actuating heads 48 of the side tools, the pieces falling down through chute 56.

In order to prevent slipping of the feed, the blank 1 is maintained clean and dry while engaged by the feed rolls 3, 3, and the necessary lubrication of the blank is done after it has passed the feed. This is accomplished by an ordinary oil pump 57 (see Fig. 1) which drips the lubricant down in funnel 58 mounted centrally over the blank 1. Soap and water is preferably used as a lubricant, because it does not leave a stain on a fabric tape.

The supply of tape is wound on spool 59 (Fig. 1) and passes from there through passageway 60 under the bed of the machine and up through tension 61 (see Figs. 15 and 17), also passing through the hole and slot 45 (see Fig. 3) in the die unit 10. The tape then passes between the sides of the blank 1 where the interlocking members are clamped around the corded edge, and then leads through slot 62 in the punch holder and then around disk 63 (see Figs. 15 and 17). Then the stringer or tape leads to spool 64 (see Figs. 1 and 2) on which it is wound up by belt 65 driven from the main shaft.

The movements of the tape are controlled by the disk 63 on shaft 66. Shaft 66 is driven by ratchet 67 (see Figs. 17, 11 and 12) through pawl 68, bell crank 69 and pitman 70 connected to crank plate 71 by radially adjustable crank pin 97 mounted on the main shaft 8. The grip of disk 63 on the tape is produced by the sliding shoe 72 (see Figs. 15, 16 and 17) which presses the tape against a knurled or roughened periphery of disk 63. The grip is also obtained by pressure of the tape on the knurled disk 63 produced by the tension 61, whose function is to hold the tape taut between the die unit 10 and the tape feed control at disk 63. Disk 63 has a groove 73 for the jaw members on the stringer, which groove serves as a leader and prevents the tape from lateral displacement while passing around the disk 63. Sliding shoe 72 is pressed against the disk 63 by springs 74, whose tension is released by lever 75 in the position shown in Fig. 16. The springs 74 are made of such length as to permit the shoe 72 to be lifted out of contact with the disk 63, (see Fig. 16) to facilitate the threading or removal of the tape between the disk and the shoe.

Fig. 21 shows the position of the shoe 72 relatively to the disk 63. By reason of the shoe being pointed at the tape entering end, producing friction between the slanting edge 76 and the tape sliding under shoe 72, the tape tends to follow the direction of edge 76, or to work itself over to the side. Thus the corded edge of the tape, with or without metal, is sliding with considerable pressure against the edges 98 of the shoe 72, and the edges of the groove in disk 63, thus placing the grip on the tape close to the corded edge. The corded tape is made so that the corded edge is shorter than the free edge, the latter being wavy, so that the corded edge thus takes practically all of the strain of the feed. It is therefore necessary in order to secure even and uniform spacing of the jaw members, that the tape be gripped in feeding close to the corded edge. The clamping of the jaw members on the tape produces some elongation of the corded edge of the tape.

The slanting edge 76 has the additional function of preventing puckering or doubling up of the tape in front of shoe 72. This is because the point of shoe 72 slides over the tape near the corded edge, at a point where the tape is not only taut but is held firmly by its attachment to the cord, so that as the tape glides in under the shoe, the edge 76 flattens out any wrinkles in the same manner as the divergent edges of a flat iron would do.

Instead of the shoe 72, a slightly conical idler roller having its high edge engaging the corded edge of the tape can be used to press the tape against the knurled periphery of disk 63. This idler roller being controlled by springs 74.

The tape tension 61 (see Figs. 15 and 18) comprises two tension plates 77 having grooves for the cord which provide guiding means as well as friction surface. These plates are mounted loosely on the ends of jaws 61 which are pivotally connected at 103 and normally pressed apart by spring 107 mounted between screw bushings 79 which can be turned so as to vary the spring pressure at plates 77. The pressure on the jaws is transmitted through the screw 78 disposed at about the center of the plates 77, so that the plates can rock slightly on the ends of the screws and adjust themselves to irregularities in the tape without affecting the friction. In order to prevent puckering, the plates 77 at the lower or entering end are tapered or cut away so as to smooth out a puckered or wrinkled tape in the same manner as above described with respect to edge 76 of shoe 72. The tape tension is not fastened to the machine, but is held in place by the friction of the tape which in its upward motion holds the tension against the lower side of die unit 10. 80 (see Fig. 17) is a brake holding the shaft 66 and tape roll 63 against movement except through ratchet 67.

The throw of pawl 68 (Figs. 11 and 12) which drives the tape feeding shaft 66 through ratchet 67 is made longer than is necessary to feed the required length of tape for proper spacing. To regulate the spacing, (see Fig. 11) a shield 81 is provided which prevents the pawl 68 from dropping on the teeth of ratchet 67 until the desired throw of shaft 66 has been provided. The spring 82 pushes the pawl into engagement with the teeth as soon as the pawl clears the shield 81. The shield 81 is adjustable around shaft 66 so as to control the number of teeth pawl 68 will feed.

The present machine is designed to fix a predetermined number of equally spaced jaw members on a given length of tape, and then to feed a blank length of tape to enable the fasteners to be cut apart to receive the additional sliding member not shown herein and also end stop devices. The pawl 68 automatically feeds the excess length of tape required for this purpose, through a second pawl 83 (see Figs. 13 and 14) pivoted on pin 84 and held against pin 85 by spring 86. Pawl 83 is mounted on the friction ratchet 87, mounted between ratchet 67 and shield 81 with a bearing fit on shaft 66. The secondary pawl 83 thus extends over teeth of ratchet 67, and the friction ratchet 87 is held against accidental rotary movement by brake 88 (see Figs. 13 and 14) fastened to shield 81 by screw 89. As the secondary pawl 83 is carried around on the friction ratchet 87, it reaches the position where pawl 68 at the rear end of its stroke rides over it. At the beginning of the forward movement pawl 68 then catches the secondary pawl 83. The spring 86 (see Fig. 13) yields to the pressure of pawl 68, allowing the secondary pawl 83 to swing until its forward edge engages the teeth of ratchet 67. The swinging movement being arrested, continued pressure of pawl 68 carries with it the secondary pawl 83, the two ratchets 87 and 67, the shaft 66 and the tape. The ratchet 87 is moved by ring 98 (see Fig. 13) through rolls 90 and spring 91. Arm 92 which operates ring 98 is operated by the spring 93 and the pin 94 in clamp 95 attached to the connecting rod 6, and operated by eccentric 7. The stroke of arm 92 is adjustable by the micrometer head 96 in bracket 97 (see Fig. 14) attached to the frame of the machine. The adjustment ranges from a maximum length equal to the throw of connecting rod 6 to a very small minimum. Thus the secondary pawl 83, carried around by the friction ratchet 87, is made to complete a single revolution during a predetermined number of operations of the machine according to the setting of micrometer 96. When the secondary pawl 83 is effective, it will be seen that a long throw will be given the tape feed, equal to the full stroke of pawl 68.

If not much variation in the lengths of fasteners is required, the friction ratchet with secondary pawl 83 can be dispensed with. In this case the ratchet 67 is provided with a high tooth 99 (see Fig. 11) which will project up above the surface of shield 81 so as to be caught by pawl 82 during each revolution of ratchet 67. By changing the throw of pawl 68, the length of the metal part of the fastener can be varied to a limited extent without changing the over-all length including the tape ends. To materially change the length of the fastener the number of teeth in the ratchet 67 can be varied, and also the diameter of feed disk 63.

The fastener members as affixed to the tape may require further finishing to remove burs, but this can be done after the members are attached to the tape much more cheaply than by additional finishing operations in the machine before the members are pressed on the tape.

While the machine has been described with reference to the making of the members from a strip, the novel principles of the invention are applicable to the feeding of separate pieces, and it will be obvious that in applying these broad features of the invention to other machines some of the parts herein described may be modified or omitted entirely without departing from the invention, and all such modifications will be within the scope of the appended claims.

Having thus described my invention, I declare that what I claim as new and desire to secure by Letters Patent, is:—

1. The combination of means for cutting a flat member having separated compressible jaws at one end, means for forming a recess and head on the other end, means for feeding the jaw end astride a carrier, means for feeding the carrier, and means for pressing the jaws together on the carrier.

2. The combination of means for cutting a flat member having separated compressible jaws at one end, means for forming a recess and head on the other end, means for feeding the jaw member adjacent a carrier, and means for pressing the jaws together on the carrier through interposed means preventing tool marking of the jaw member.

3. The combination with means for punching out a blank, of means for replacing the punching in the blank, means for feeding the blank and punching forward, means for shaping the punching, means for clamping the punching to a carrier, and means for separately feeding out the blank.

4. The combination with blank feeding means of complete punching out means, means for replacing the punching in original position in the blank to permit it to be further fed by said blank feeding means, means for feeding a carrier, and means for setting the punching on the carrier by pressure through the blank after the punching has been replaced in the blank and fed away from said punching out means.

5. The combination with blank feeding means, of means for punching out and replacing in the blank a jaw member, means for shaping said jaw member, means for feeding a carrier member between the jaws of said shaped member while held in the blank, and means acting on said blank for setting said jaw member on said carrier member.

6. The combination with blank feeding means, of means for punching out and replacing in the blank a jaw member, means for shaping said jaw member, means for feeding a carrier between the jaws of said shaped member while held in the blank, means acting on said blank for setting said jaw member on said carrier member, and means for feeding the carrier member and the attached jaw member away from the blank.

7. The combination with means for feeding a blank, of means for forming and replacing a punching in the blank, means for shaping the punching and simultaneously applying pressure to opposite edges of the blank, and means for feeding out the punching and the blank.

8. The combination with blank feeding means, of punching means, means for compressing the blank edgewise, means for replacing the punching in the blank, and means for shaping the punching and coöperating means for holding it and the blank against lateral distortion.

9. The combination with blank feeding means, of punching means, means for compressing the blank edgewise, means for replacing the punching in the blank, means for shaping the punching and coöperating means for holding it and the blank against lateral distortion, and means for feeding a stringer and setting the shaped punching thereon.

10. The combination with blank feeding means, of punching means, means for replacing the punching in the blank, means for feeding a carrier element transversely of the blank and the replaced punching, and means for setting the punching on said carrier element.

11. The combination with blank feeding means, of means for punching out a member to be set on a carrier element, means for feeding a carrier element to the point of attachment, and setting means acting through an interposed waste part of said blank.

12. The combination with a blank and blank feeding means, of means for punching out a member from said blank in condition to be compressed, a compressing tool, said feeding means interposing a portion of the blank between the tool and the punched out member to be compressed.

13. The combination with means for feeding a member to a compressing tool, and a compressing tool, of means for guiding a protective piece between the tool and the member to be compressed.

14. The combination with a blank and blank feeding means, of a die unit and a

spaced stripper plate, interposed movable side guides, means for punching said blank and means for actuating the guides toward each other to compress the blank at the moment of punching.

15. The combination with a blank and intermittent blank feeding means, of a die unit and a spaced stripper plate, interposed movable side guides, means for punching said blank and means for actuating the guides toward each other to compress the blank at the moment of punching and for spreading the guides while the feed is effective.

16. The combination with intermittent blank feeding means, of punching means, and movable means for clamping the blank against sidewise spreading while being punched and releasing the blank during the blank feeding.

17. The combination with intermittent blank feeding means, of compressing means, means for punching out and replacing the punching in the blank, means for holding said punching under transverse compression while said punching and replacing takes place, means for relieving the compression for the next feed, means for forming a projection on the replaced punching, and yielding means permitting passage of the projection out of its die without displacing it from its blank, upon further feed of the blank.

18. The combination with blank feeding means, of means for punching out a member from the blank, die means for forming a projection on said member simultaneously with means holding the member under side and face compression, and means for relieving both of said compressions to permit said blank feeding means to feed said member out of the projection forming die.

19. The combination with blank feeding means, of a punch for cutting out a member having jaws, means for replacing the punching in the blank and for feeding stepwise forward, a second punch for ejecting a waste piece adjacent the jaws of said member, means for forming a projection in said member, and means for feeding the punching out of the machine.

20. The combination with means for cutting a member having jaws, means for forming a socket in said member, of means for feeding a carrier element transversely between said jaws, and side punches for automatically pressing the jaws toward each other on the edge of said element.

21. The combination with means for cutting a member having jaws, means for forming a socket in said member, of means for feeding a tape between said jaws, and means for pressing the jaws on the edge of the tape.

22. The combination with means for cutting a member having jaws, means for forming a socket in said member, of means for feeding a continuous carrier element between said jaws, means for pressing said jaw members on said carrier element, and means for varying the feed of said continuous carrier element to vary the spacing of said jaw members.

23. The combination with means for cutting a member having jaws and means for forming a socket in said member, of means for feeding a tape between said jaws, means for controlling the tape tension, and means for automatically pressing the jaws on the edge of said tape.

24. The combination with means for feeding attachable jaw and socket elements, clamping means for holding the said elements and setting means for the jaws, of means for feeding a corded tape to receive said jaws on the corded portion of said tape, and tension means engaging the corded portion of said tape.

25. The combination with means for punching out a blank, of means for replacing the punching in the blank, means for feeding the blank and punching forward, means for clamping the punching to a carrier, and means for separating the blank and the attached punchings.

26. The combination with intermittent blank feeding means, of complete punching out means, means for replacing the punching in original position, and movable means for clamping the blank against sidewise spreading while said replacement of the punching takes place.

27. The combination with blank feeding means, of punch and die mechanism for cutting out a jaw member and a waste piece adjacent the jaws of said member, means for replacing the punchings in the blank for the purpose of feeding stepwise forward and means for pushing out said waste piece.

28. The combination with blank feeding means, of means for punching out pieces, comprising a piece having jaws and a waste metal piece, means for replacing the pieces in original position in the blank for further feeding by said blank feeding means, means for separating the jaw piece from the blank and means for removing the waste piece.

29. The combination with blank feeding means, of a punch and die mechanism for cutting out two pieces, means for replacing the pieces in the blank, means for feeding the blank and pieces, means for forming one of said pieces while held in the blank, and means for pushing out the other piece.

30. The combination with means for feeding a sheet metal blank, of means for punching out of said blank and replacing therein a punching having separated jaws at its forward end, and means for attaching said jaws to a carrier element.

31. The combination with means for feed-

ing a sheet metal blank, of means for punching out of said blank and replacing therein a punching having separated jaws at its forward end, and means for transversely compressing said jaws around a carrier element.

32. The combination with means for feeding a sheet metal blank, of means for punching out of said blank and replacing therein a punching having separated jaws at its forward end in a common plane, and means moving parallel to said plane for compressing said jaws toward each other around a carrier element.

33. The combination with means for forming a socket and a projection adjacent the end of a member having jaws, of means for feeding a carrier element between said jaws, and means for automatically pressing the jaws on said element.

34. The combination with means for feeding a member having jaws at its advancing end, of means for intermittently feeding the edge of a carrier element transversely and between said jaws, and means for setting the jaws on the edge of said element.

35. The combination with means for feeding a socket member having jaws at its advancing end, of means for intermittently feeding a tape transversely between said jaws, and means for setting the jaws on said tape.

36. The combination with means for affixing a member to a strip, of means for feeding the strip at one rate to space the members, and means periodically varying the strip feed to group the spaced members.

37. The combination with means for forming and affixing a member to a strip, of means for feeding the strip at one rate to space the members, and means periodically varying the strip feed to group the spaced members.

38. The combination with means for affixing members to a strip, of means for feeding the strip, and means for varying the strip feed to vary the spacing between the members.

39. The combination with means for affixing groups of members to a strip, of means for varying the spacing between members of a group by varying the feed of the strip.

40. The combination with means for affixing groups of members to a strip, and strip feeding means, of means for feeding an increased length of strip between groups, and means for regulating the number of members in a group.

41. The combination with means for affixing groups of members to a strip, o' means for feeding an increased length of strip between groups, and means for regulating the spacing of the members in a group.

42. The combination with means for feeding a strip and means for affixing fastening members on the edge thereof, of actuating means for effecting normal spacing of said members, and additional means for effecting an increased strip feed after a predetermined number of members are affixed.

43. The combination with means for successively affixing jaw members to a corded tape, means for feeding the corded tape between the jaws, means acting on the corded part of the tape to carry the feeding strain, and tension means also acting on the corded part of the tape.

44. The combination with means for feeding a fabric strip step by step, of means for feeding jaw members to and compressing same on the edge of said strip, tension means for the strip, and a fine adjustment for controlling the strip feed for maintaining accuracy of spacing of said jaw members.

In testimony whereof I affix my signature, in presence of two witnesses.

GIDEON SUNDBACK.

Witnesses:
NOEL POUX.
ALGER F. RUSSELL.

DISCLAIMER

1,331,884.—*Gideon Sundback*, Meadville, Pa. SHEET-METAL FORMING AND SETTING MACHINE. Patent dated February 24, 1920. Disclaimer filed January 30, 1933, by the assignee, *Hookless Fastener Company*.

Therefore disclaims:

(*a*) From the scope of the claim numbered 34, any combination except one in which the member having jaws at its advancing end is a slide fastener member of the character described in Sundback patent No. 1,219,881, and which has means for automatically supplying such members to the feeding means.

(*b*) The claim numbered 38 in toto.

[*Official Gazette February 21, 1933.*]

1,331,384.—*Gideon Sundback*, Meadville, Pa. SHEET-METAL FORMING AND SETTING MACHINE. Patent dated February 24, 1920. Disclaimer filed January 17, 1934, by the assignee, *Hookless Fastener Company*.

Hereby enters this disclaimer to that part of said specification which is in the following words, to wit:

"This invention relates to a machine for forming and setting metal punchings, and has particular reference to a special form of power press with automatic blank feeding means whereby punchings are formed from a strip blank and set on a carrying element." (p. 1, lines 10 to 16.)

"The present invention is not limited in its broad aspects to the production of the particular fastener members referred to, nor to the setting of such members on tapes, but is of general application wherever it is desired to automatically and cheaply form large numbers of like parts, and to set them on a suitable carrier element." (p. 1, lines 36 to 43.)

And your petitioner further disclaims from the scope of each of claims 1 to 33, inclusive, 35, 36, 37, and 39 to 44 inclusive, any combination except one for forming and affixing to a tape carrier, slide fastener members such as are described in the sentence beginning at line 21 of page 1 of the specification and reading as follows:

"The fastener members consist of separated jaws and an interlocking member having a recess on one side and a head on the other, these respective recesses and heads being arranged on a pair of tapes so as to alternately interlock."

[*Official Gazette February 6, 1934.*]

DEFENDANT'S EXHIBIT "F"

G. Sundback Patent No. 1,947,956

Filed Dec. 19, 1928 Patented Feb. 20, 1934

Feb. 20, 1934. G. SUNDBACK 1,947,956

FASTENER FORMING AND ASSEMBLING MACHINE AND METHOD
OF SECURING FASTENER ELEMENTS TO TAPE

Filed Dec. 19, 1928 8 Sheets-Sheet 1

Fig. 1.

Fig. 2.

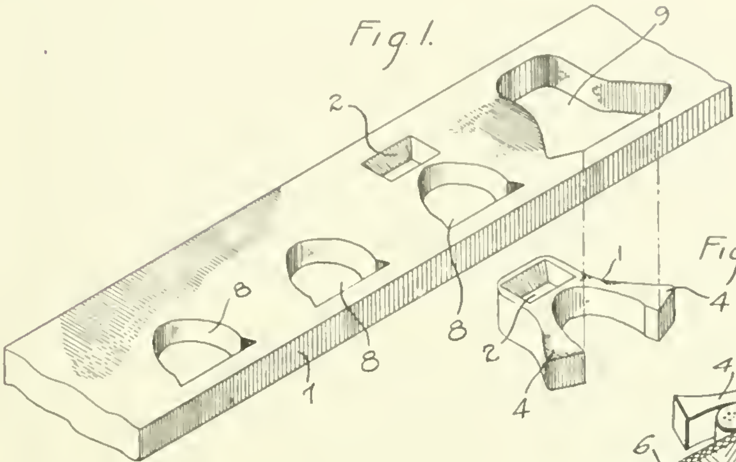
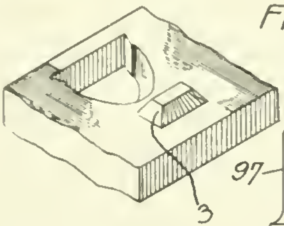


Fig. 3.



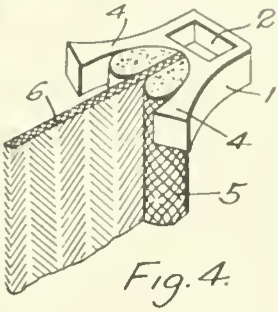
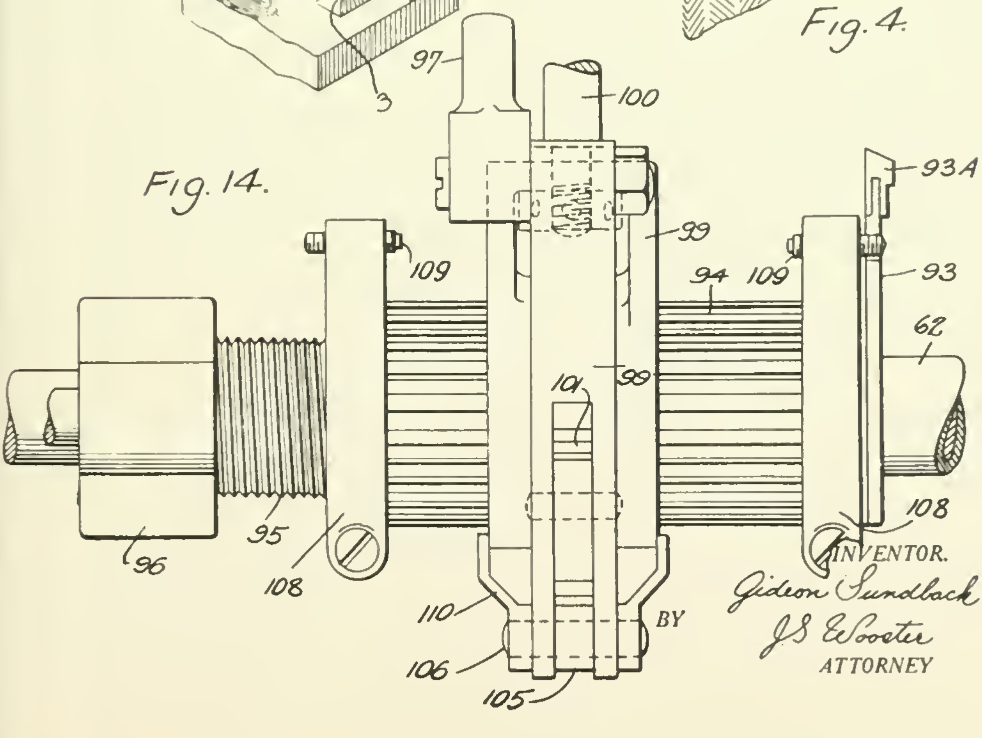


Fig. 4.

Fig. 14.



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FASTENER FORMING AND ASSEMBLING MACHINE AND METHOD OF SECURING FASTENER ELEMENTS TO TAPE

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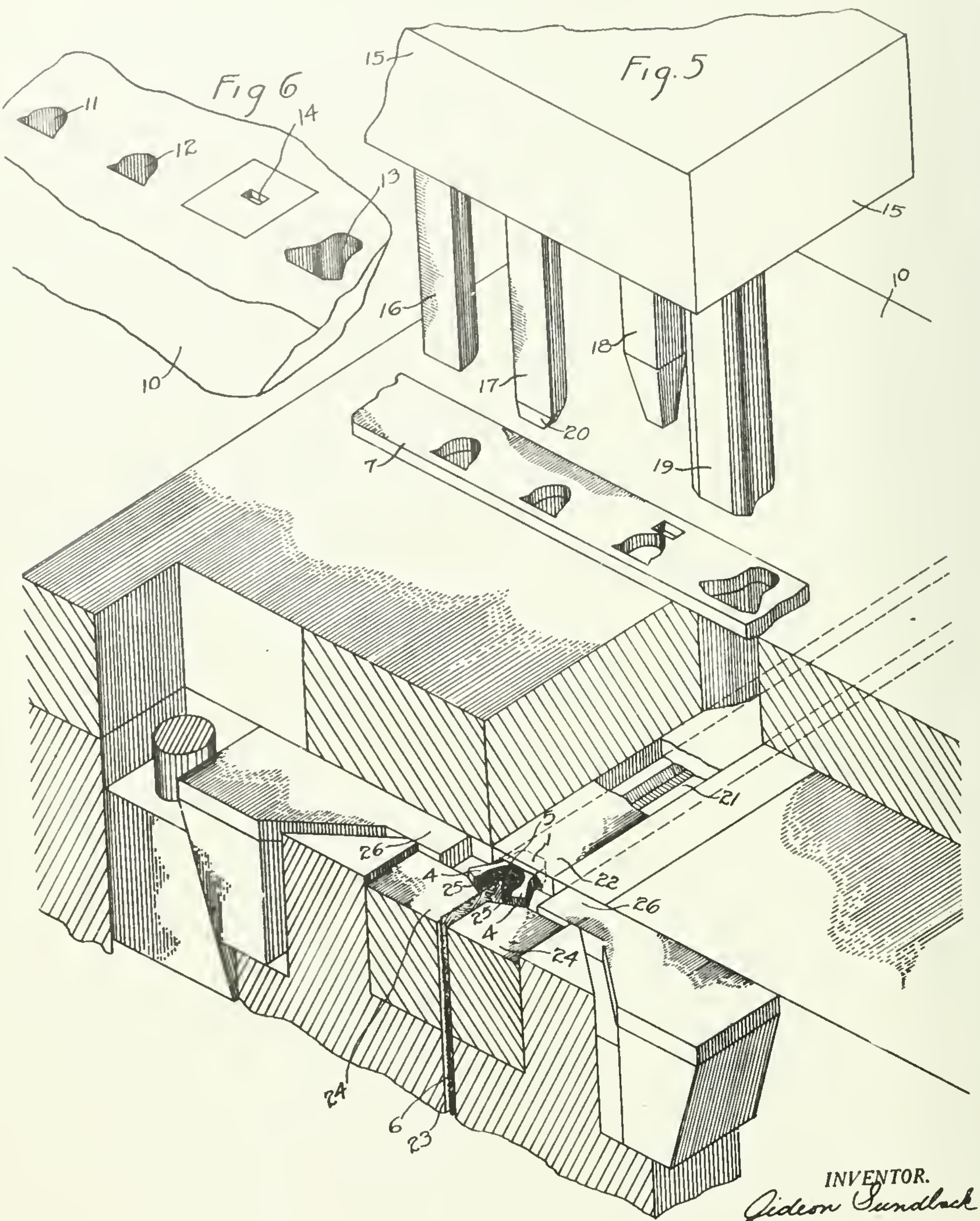

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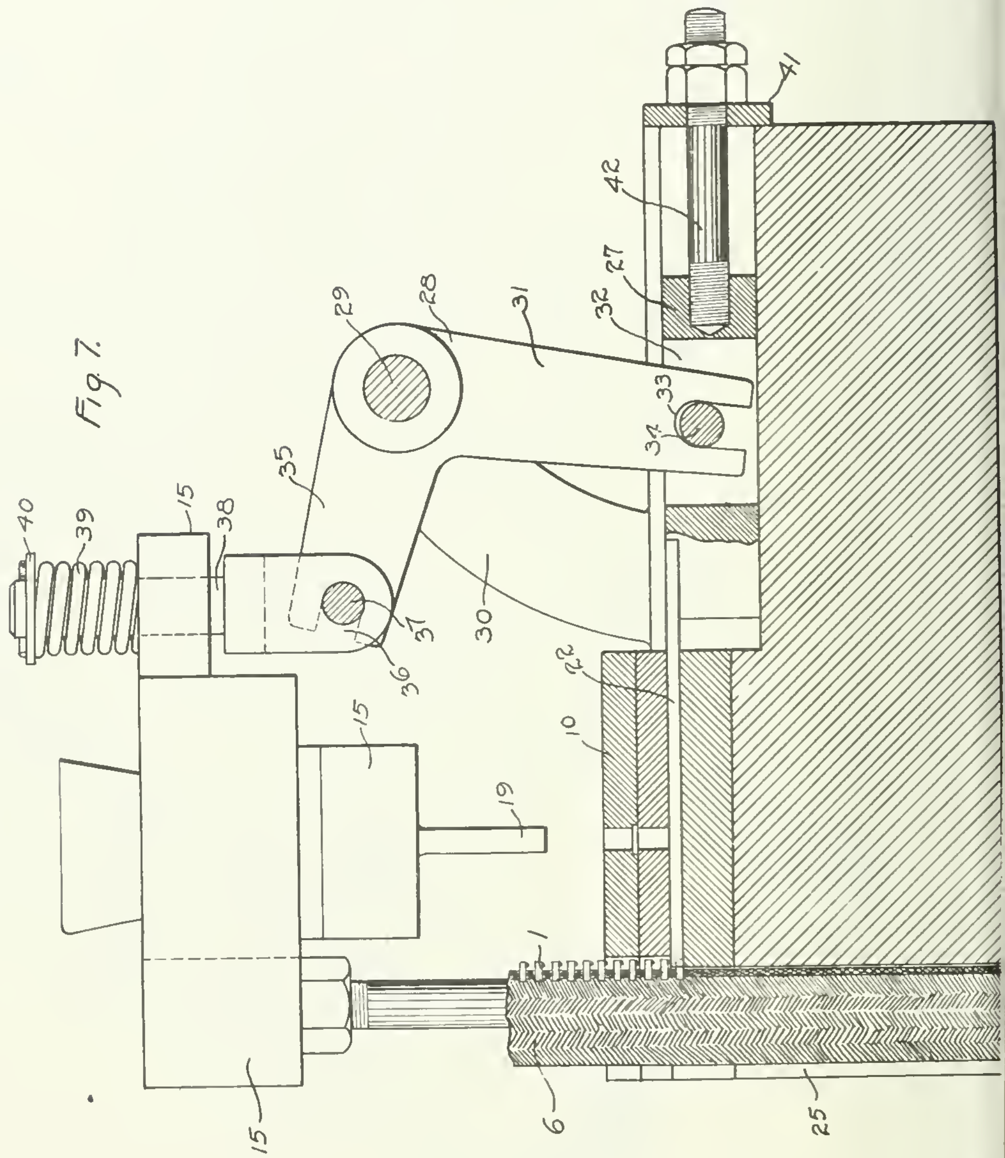
Fig. 7.



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FASTENER FORMING AND ASSEMBLING MACHINE AND METHOD
OF SECURING FASTENER ELEMENTS TO TAPE

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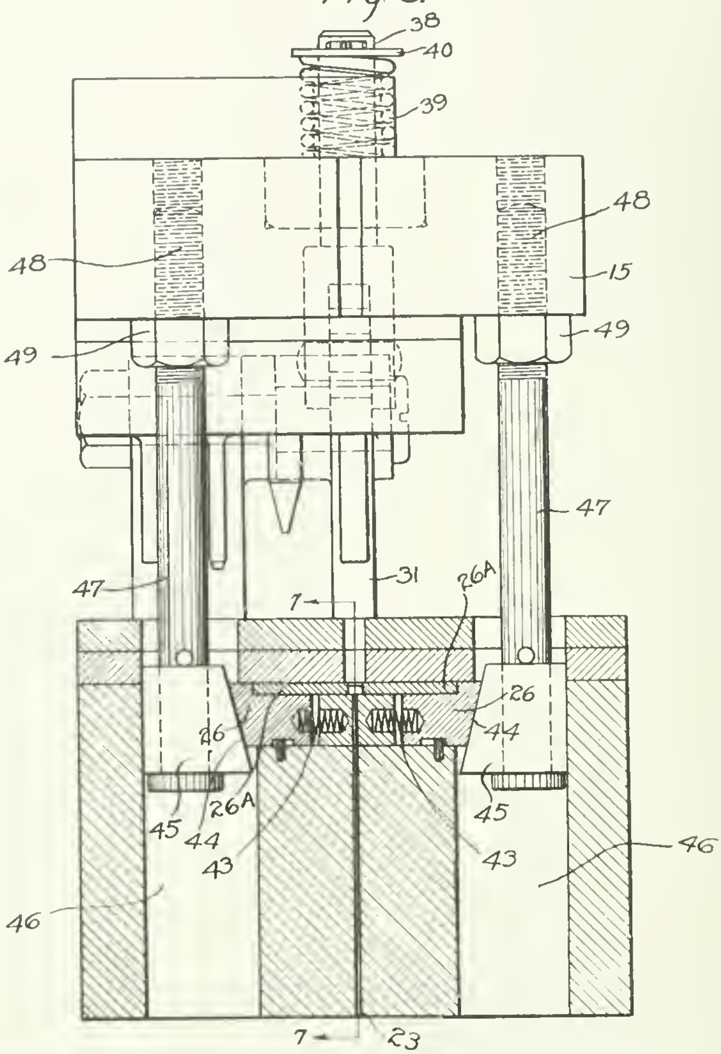
Fig. 8.



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FASTENER FORMING AND ASSEMBLING MACHINE AND METHOD
OF SECURING FASTENER ELEMENTS TO TAPE

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Fig. 9.

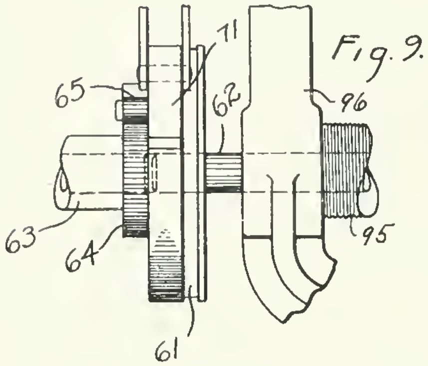


Fig. 10

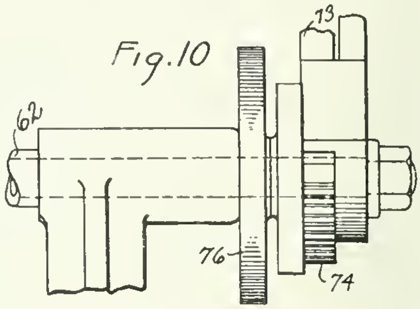
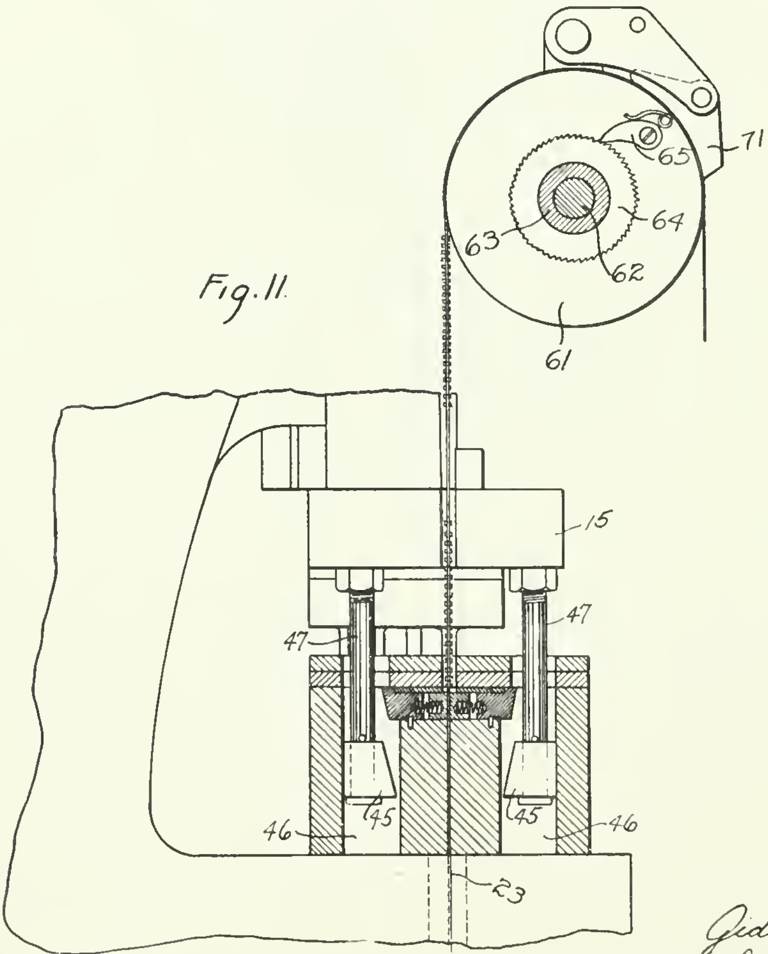


Fig. 11.



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FASTENER FORMING AND ASSEMBLING MACHINE AND METHOD OF SECURING FASTENER ELEMENTS TO TAPE

Filed Dec. 19, 1928 8 Sheets-Sheet 6

Fig. 12.

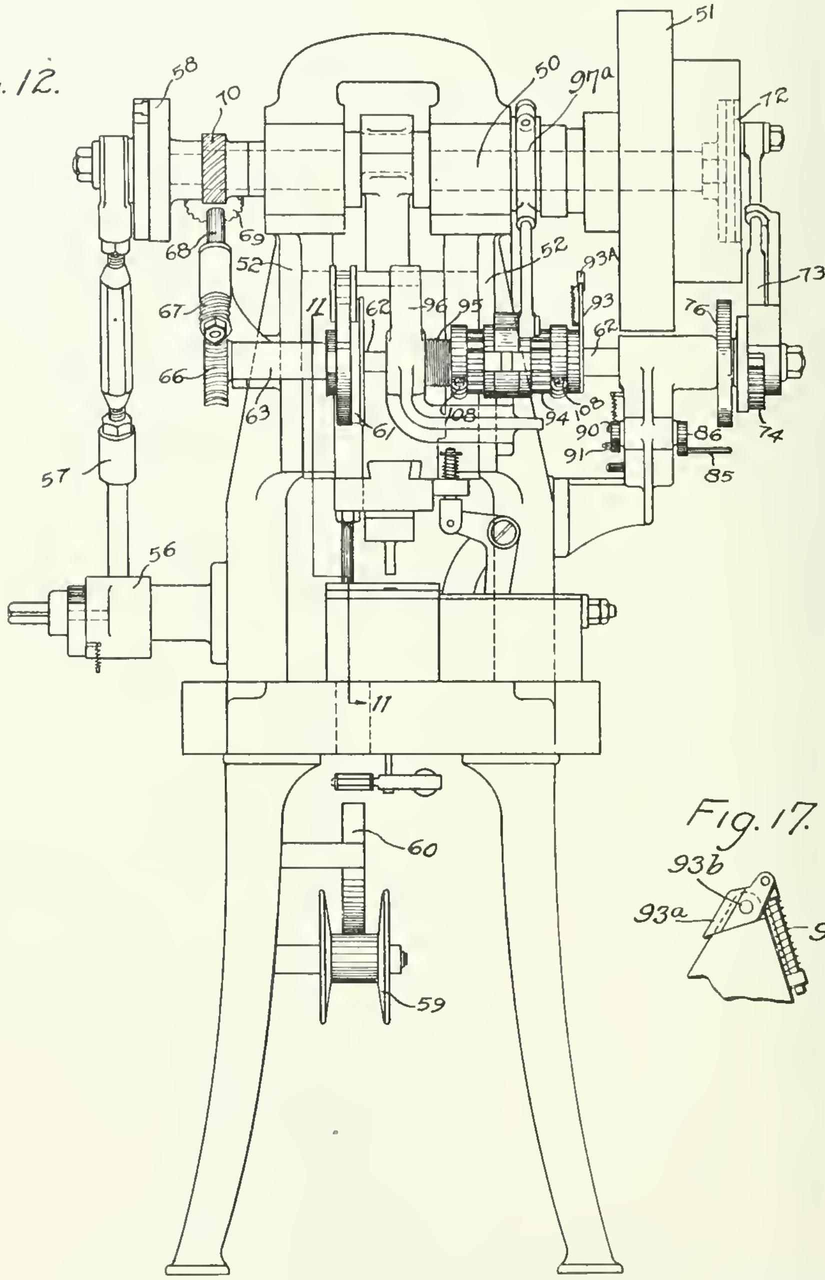

Fig. 17.

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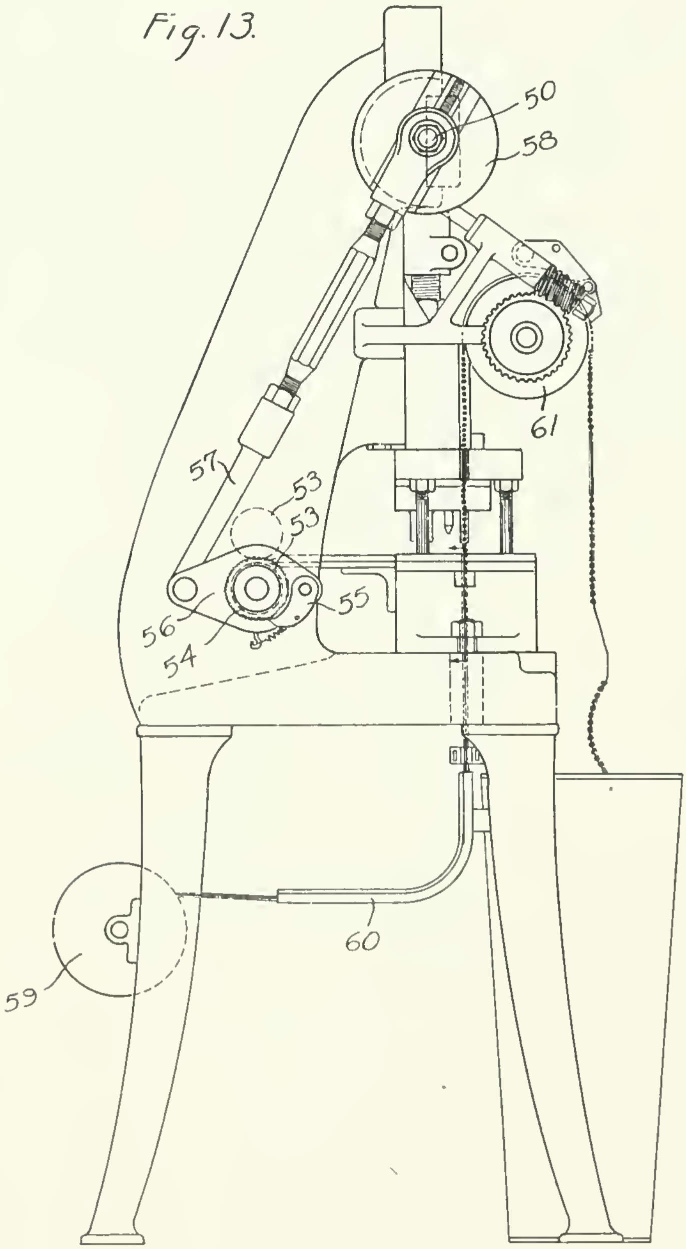
Fig. 13.



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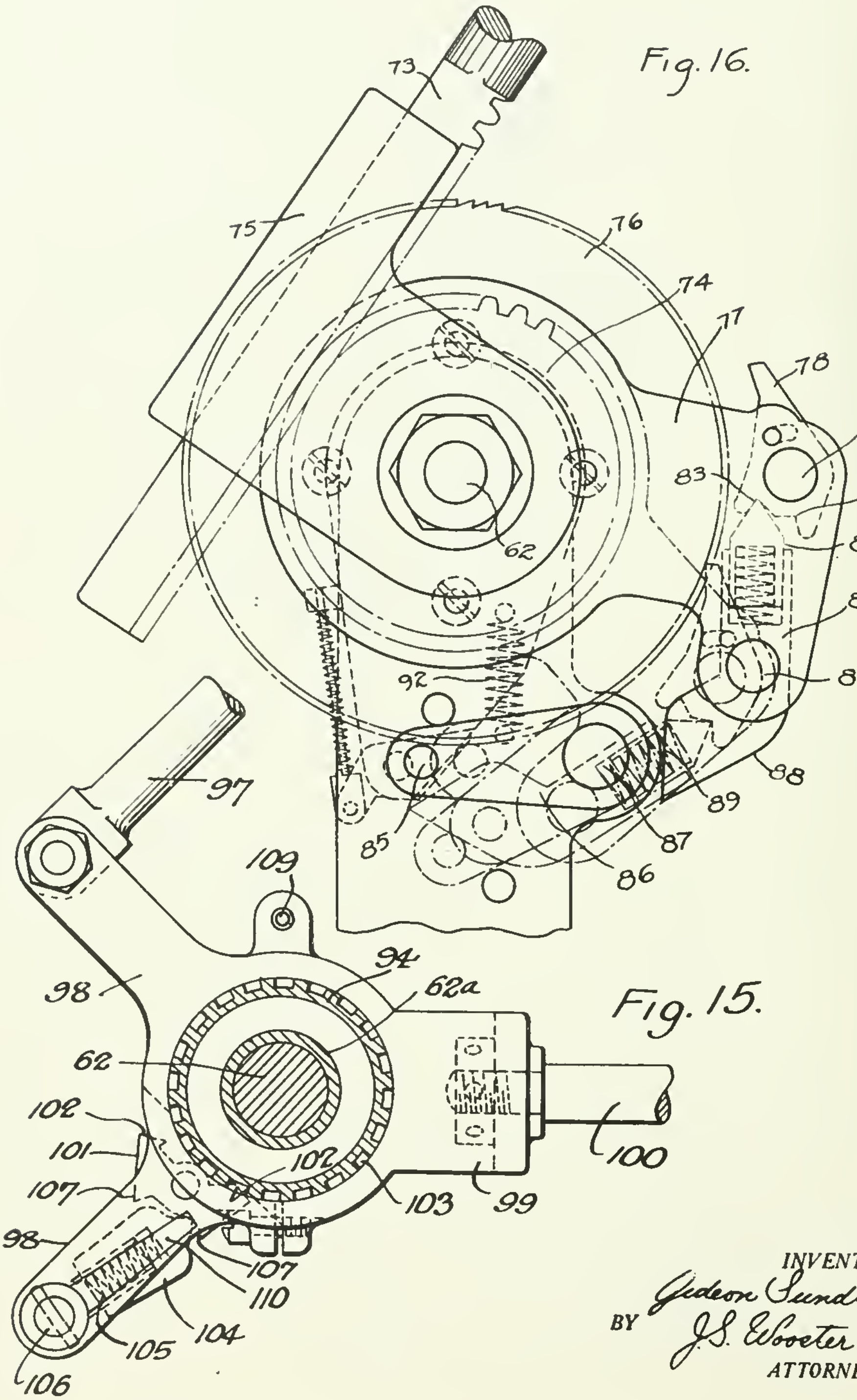

Fig. 16.

Fig. 15.

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FASTENER FORMING AND ASSEMBLING MACHINE AND METHOD OF SECURING FASTENER ELEMENTS TO TAPE

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This invention relates to a fastener forming and assembling machine in which fastener elements are formed and attached to a holding strip such as a strip of corded tape and to a method of making fasteners. The present invention has for one of its objects to provide a forming and assembling machine of the character above referred to, which operates rapidly and efficiently.

Another object of the invention is to provide an improved method of making fasteners including several novel steps and novel combinations of steps.

A further object of the invention is to provide a machine in which the fastener elements are successively formed from metal stock and in which each fastener element is fastened to the holding strip immediately after it is formed.

A further object is to provide a machine in which the fastener elements are formed from metal stock in a reciprocating press and in which a fastener element is delivered from the press and fastened to the holding strip during each interval between forming strokes of the press.

A further object is to provide fastener positioning and attaching means which are directly operated from the reciprocating head of the press in proper timed relation with respect to the stroke of the press.

A further object is to provide means for delivering the fastener elements to the holding strip and for holding the strip and fastener elements in proper position with respect to each other while the fastener element is being clamped to the strip.

A further object is to provide fixed abutments on opposite sides of the strip at the point to which the fasteners are attached thereto against which the jaws of the fasteners are pressed to properly position the same with respect to the strip, together with means for compressing the jaws into clamping engagement with the strip.

A further object is to provide a reciprocating feeder for shifting the fastener element into engagement with the abutment, which is provided with the yielding actuating connections so that the fasteners will yieldably hold while their jaws are being compressed into clamping engagement with the strip.

A further object is to provide means in connection with the forming press to accurately position the metal stock with respect to the punches upon each stroke of the head.

With the above and other objects in view, the invention may be said to comprise the fastener forming and assembling machine and method as illustrated in the accompanying drawings hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention appertains.

There are various novel steps in the method which will be described specifically and various novel combinations of steps that can be carried out by more than one machine or by a single machine of any suitable construction.

Reference should be had to the accompanying drawings forming a part of this specification in which:

Figure 1 is an isometric view of a flat metal blank showing the operations that take place in forming a fastener element.

Fig. 2 is an isometric view showing a fastener element which has been severed from the metal stock.

Fig. 3 is an isometric view showing the reverse side of the metal blank.

Fig. 4 is an isometric view showing a fastener element in the position in which it is clamped to the corded tape.

Fig. 5 is an isometric view showing the punch and die assembly, together with the plungers for transmitting the fasteners to strip engaging position and for clamping the fastener jaws on the corded edge of the tape.

Fig. 6 is an isometric view showing the opening in the die.

Fig. 7 is a vertical section taken on the line indicated at 7—7 in Fig. 8.

Fig. 8 is a sectional elevation showing the plungers for clamping the fasteners on the tape and the actuating means for these plungers.

Figs. 9 and 10 are detail views of the tape feed mechanism.

Fig. 11 is a vertical section taken on the line indicated at 11—11 in Fig. 12.

Fig. 12 is a front elevation of the machine.

Fig. 13 is a side elevation of the machine.

Fig. 14 is a detail view showing the mechanism for controlling the intermittent actuations of the feed drum.

Fig. 15 is a transverse section through the mechanism shown in Fig. 14.

Fig. 16 is a detail view showing the ratchet and pawl mechanism by means of which the drum is periodically actuated.

Fig. 17 is a detail view of a portion of the feed control mechanism.

The present invention is employed in the manufacture of separable fasteners of progressively interlocking type which are employed to continuously interlock edge to edge flaps of flexible material.

The edges of the flaps have attached thereto at closely spaced points, jaw or fastener elements which are progressively interlocked or disengaged by means of a slider mounted for movement over the fastener elements of the two flaps. The fastener elements are ordinarily attached at regularly spaced points to holding strips which are secured along the edges of the flaps. The present invention in one of its aspects relates to a machine for forming the fastener elements and attaching them to a holding strip suitable for attachment to the flaps which are to be joined by the fastener.

The fastener element 1 shown in Figs. 2 and 4 is provided at one end thereof with a recess 2 in one face and with a corresponding projection 3 on the opposite face, the projection 3 being formed to fit in the recess 2 of an identical fastener element, as well understood in the art.

The fastener element is also formed with spaced compressible jaws 4 which are adapted to straddle a cord 5 secured along an edge of a fabric tape 6, as shown in Fig. 4, and to be compressed into clamping engagement with the cord 5 to permanently secure the fastener element to the tape. The fastener elements are formed from a flat strip 7 of metal stock by first punching in the stock an opening 8 which corresponds to the space between the clamping jaws 4, then compressing the stock between suitable dies to form the recess 2 and projection 3, adjacent one end of the opening 8. The complete fastener element is then punched from the stock, leaving a large opening 9 therein of the same size and shape as the fastener element.

The fastener forming operations are performed in a suitable press such as illustrated in Figs. 5 and 6, the press being provided with a suitable bed 10 which has die openings 11 and 12 of the same size and shape as the openings 8 to be formed in the metal stock. The bed 10 also has a die opening 13 of the same size and shape as the fastener element and of the same size as the opening 9, which is formed in the metal stock when the fastener is punched from the stock. Midway between the openings 12 and 13 of the bed, the bed has a die recess 14 in which the projection 3 of the fastener element is formed. The press has a suitable head 15 which is mounted for reciprocation toward and from the bed 10 and this head carries punches 16 and 17 which are alined with the die openings 11 and 12 of the bed, and punch 18, which is alined with the die recess 14 and which has a point which conforms to the recess 2 of the fastener element. The head 15 also has a punch 19 which is in alinement with and conforms to the die opening 13 of the bed. As shown in Fig. 5 a positioning punch 17 is located between the punches 16 and 18 and is somewhat longer than the others. This punch has a tapered end 20 and it will be readily seen that it will enter one of the openings formed by punch 16 and position the piece of stock so that the other tools will act on the metal at the proper place.

Extending transversely beneath the opening 13 of the bed, there is a guideway 21 of substantially the same width as the opening 13 to receive the fastener elements discharged by the punch 19 and in this guideway, there is mounted a reciprocating plunger 22 for advancing the fastener elements in the guideway. At the front of the machine, the frame of the machine is provided with a slot 23 to receive the tape 6, which is supported in the slot 23 with its corded edge 5 toward the guideway 21, the slot 23 being positioned centrally of the guideway so that the jaws of the fastener elements may be advanced to a position in which they straddle the corded edge 5 of the tape.

In order to properly position the fastener element with respect to the tape, fixed abutments 24 are secured on opposite sides of the tape 6 at the end of the guideway 21 and these abutments have beveled edge portions 25 on the inner sides thereof with which the ends of the jaws 4 of the fastener elements engage.

For clamping the fastener elements on the tape, a pair of post plungers 26 are mounted on opposite sides of the tape for movement into and out of engagement with the jaws of the fastener element, straddling the tape and held against the abutments 24. The plungers 22 and 26 are operated in timed relation with respect to the movements of the head 15 of the press to move each fastener element as it is separated from the metal stock into engagement with the abutments 24 and to compress the jaws thereof into clamping engagement with the corded edge 5 of the tape to permanently secure the fastener element to the tape, the tape being continuously fed at a suitable rate to provide the desired spacing between the fastener elements.

As best shown in Fig. 7 of the drawings, the plunger 22 is attached to a suitable slide 27 mounted in the guideway at the rear of the bed 10 and this slide is directly actuated from the head 15 of the press through a bell crank lever 28 which is mounted to swing on a fixed pivot 29 carried by a bracket 30 fixed to the frame of the machine. The bell crank lever 28 has a downwardly extending arm 31, the lower end of which extends into a slot 32 in the slide 27 and has a forked end 33 straddling a pin 34 extending across the slot 32 of the slide. The other arm 35 of the bell crank lever extends forwardly of the pivot 29 and has a forked end 36 straddling a horizontal pin 37 carried by the lower end of a vertical post 38 which is slidably mounted in the head 15. The post 38 is yieldably supported on the head 15 by means of a coil spring 39 which is interposed between the upper face of the head and a washer 40 secured upon the upper end of the post 38.

It will be apparent that when the head 15 moves upwardly, the bell crank lever 28 is rocked in a direction to move the slide 27 toward the bed 10 and plunger 22 toward the tape 6, the movement of the slide 27 being such that the plunger 22 is moved from a position in which its forward end is at the rear of the opening 13 to a position in which a fastener element engages with abutments 24, the spring 39 providing a yielding connection so that at the forward end of the stroke of the plunger 22, the fastener element is yieldingly pressed against the abutments 24 so that the fastener element is positively held during the action of the plungers 26 to compress the jaws into clamping engagement with the tape. To limit the forward movement of the slide 27 and plunger 22 and prevent excessive pressure from being exerted on the fastener element, the slide 27 is preferably provided with a stock bar 41 secured thereto by means of a bolt 42 which engages with the frame of the machine to limit the forward movement of the slide.

As best shown in Fig. 8 of the drawings, the a' compressing plungers 26 have fastener en-ang portions 26a in the form of hardened tel plates which have a thickness substantially qil to the thickness of the fastener elements n these plungers are normally held clear of guideway 21 to permit the fastener element be moved to a position between them by ns of compression springs 43 interposed be-en the plungers and the fixed abutments 24. plungers 26 have inclined outer ends 44 ch are engaged by wedge members 45 mount-for vertical movement in slots 46 provided the frame and attached to the lower ends he vertical rods 47 fixed to the head 15 of press.

he rods 47 have upper ends 48 threaded into head 15 and are held in adjusted position respect to the head by means of lock nuts During the up stroke of the head 15, the ge members 45 acting on the inclined faces of the plungers 26 force the plungers inward-gainst the jaw members 4 of a fastener ele-t to compress the jaws into clamping en-ement with the tape, the movement of the ngers 26 being so timed that they are brought engagement with the fastener element im-iately after the fastener element has been ed into engagement with the abutments 24 he plunger 22.

s shown in Figs. 9 to 13, the reciprocating d 15 is suspended from and actuated by a nk shaft 50 which is continuously driven by suitable means such as through a belt pul-51, the frame of the machine being provided h suitable vertical guides 52 for the head.

n order to feed the metal stock 7 intermit-tly and at the proper rate across the bed 10, rollers 53 are provided as shown in Fig. 13 one of these feed rollers is intermittently ated through a ratchet 54 fixed to its shaft means of a pawl 55 carried by a rocker arm leeved upon the shaft of the feed roller. The 56 is connected by an adjustable link 57 an eccentric disc 58 with which the rod 57 an adjustable connection so that the angular ke of the rocker arm 56 may be varied to vide the desired feed for the strip 7 of the al stock.

he fabric tape 6 is fed from a reel 59 through angle guide 60 into a vertical guide slot 23 movement is imparted to the tape by means drum 61 adjacent the top of the frame over ch the tape passes. The drum 61 is fixed to aft 62 and is driven from a sleeve 63, which otatably mounted on the shaft 62, through tchet 64 fastened to the sleeve and a pawl arried by the drum and engaging the ratchet. sleeve 63 has fixed thereto a worm gear 66 ch is driven by a worm 67 on a shaft 68 ch has a helical gear 69 meshing with a heli-gear 70 on the crank shaft 50. The drum s thus driven at a rate so proportioned to rate of operation of the punch carrying head o provide the proper spacing between suc-ive fastener elements applied to the tape.

he mechanism which has just been described drive the feed drum at a continuous rate it will be observed that for a very brief pe-of time the portion of tape at the clamping ion will have to remain stationary until re-ed by the side tools 26. The length of the between the clamping station and the feed n is readily capable of sufficient stretching llow the strip to be held stationary momen-ly by the clamping jaws.

It is desirable, however, that means be provided for momentarily increasing the speed of movement of the tape at predetermined intervals to provide a relatively wide space between fastener elements so that the rows of fastener elements applied to the tape will be the required length for the particular fastener in which they are to be used.

It will be noted that the pawl 65 does not interfere with the rotation of the drum 61 at a rate faster than that of the sleeve 63 and ratchet 64 and in order to provide gaps at predetermined intervals between the fasteners on the tapes, means is provided for automatically advancing the drum 61 with respect to the ratchet 64 at predetermined intervals. The drum 61 is, however, engaged by a brake 71 which imposes a drag on the drum to prevent its over-running the ratchet except when positively actuated. The advancing movement of the drum 61 is accomplished by means of a trip controlled mechanism operated from the crank shaft which will now be described.

At one end of the crank shaft 50, there is a crank 72, see Fig. 12, to which is connected a rack 73 which meshes with a pinion 74 loose on the shaft 62, see also Fig. 16, the rack 73 being held in engagement with the pinion 74 by means of a guide member 75 pivoted on the shaft 62. Upon each rotation of the shaft 50, the pinion 74 is oscillated through a relatively large angle on the shaft 62 and means is provided in connection with the pinion 74 for actuating the shaft 62 at predetermined intervals. To this end, a ratchet 76 is fixed to the shaft 62 alongside the pinion 74, and fixed to the pinion 74 there is a projecting member 77 which carries a pawl 78 which is normally held out of engagement with the ratchet 76, but which may be moved at intervals into engagement with the ratchet to impart rotation to the shaft 62.

The pawl 78 is mounted on a pivot pin 79 and is held either in or out of its ratchet engaging position by means of a trip lever 80 which is mounted intermediate its ends on a pivot pin 81 carried by the pawl carrier 77 and which carries at one end a spring pressed plunger 82 which has a pointed end engageable with closely spaced V notches 83 and 84 in the pawl 78.

When the lower end of the lever 80 is swung outwardly, the plunger 82 engages in the inner notch 83 of the pawl 78 and holds the pawl out of engagement with the ratchet as shown in full lines in Fig. 16. When the lower end of the lever 80 is swung inwardly, the plunger 82 engages in the notch 84 and holds the pawl in engagement with the ratchet as shown in phantom lines in said figure. The trip lever is actuated at intervals by means of a movably mounted trip pin 85 which may be shifted to a position to actuate the trip lever 80 at the end of the clockwise stroke of the carrier 77 in a direction to shift the trip lever 80 to a position in which it holds the pawl 76 in engagement with the ratchet during the succeeding counterclockwise stroke to impart a movement to the feed drum in excess of its normal rate of rotation in order to provide a relatively wide space between fastening elements applied to the strip. The trip pin 85 is attached to an arm 86 fixed to a shaft 87 journaled in the frame and is movable about the axis of the shaft 87 into and out of tripping position with respect to the lever 30. The oscillation of arm 86 is limited by stop members as indicated in Fig. 16. The lower end of the lever 30 has oppositely inclined faces 88 and 89, the former being engageable with the pin 85 in its tripping position to shift the lower end of the lever inwardly to engage the pawl 78 with the ratchet and the latter engaging with the pin in the non-tripping position thereof to return the pawl to inoperative position. The shaft 87 is provided with a second arm 90 having a laterally projecting pin 91 and this arm has connected thereto a spring 92 which acts to normally hold the shaft 87 at one limit of its movement with the pin 85 in its non-tripping position.

In order to cause the drum 61 to be advanced at proper intervals to space the fasteners on the strip, a trip arm 93 is caused to engage the pin 91 to swing the pin 85 and arm 86 to move the pin 85 to tripping position, the arm 93 being actuated through suitable timing mechanism from the shaft 50 so as to automatically speed up the feed of the strip after a predetermined number of fastening elements have been attached thereto.

As shown in Figs. 12 and 14, the arm 93 is attached to one end of a drum 94 which is mounted for rotative and endwise movement by means of a suitable bearing 62*a* as shown in Fig. 15. The other end of the drum is supported on the stationary screw 95 fixed to a bracket 96 carried by the frame of the machine, it being understood that the drum is threaded to cooperate with the screw 95 whereby axial movement is imparted to the drum when rotated. The arm 93 has at its outer end a member 93*a* pivoted thereto at 93*b* as shown in Fig. 17 which may rotate against the tension of spring 93c in one direction so that the trip arms 86 and 90 are actuated by the arm 93 in one direction only. Intermittent rotative movement is imparted to the drum by means of a connecting rod 97 which is eccentrically connected to the shaft 50 at one end and at its opposite end to a bell crank 98 which is mounted to oscillate about the drum between the two arms of a bracket 99 which encircle the drum. This bracket which is fixed to the frame of the machine by a bolt 100 maintains the bell crank in proper position when the drum moves axially. The bell crank 98 carries a double pawl 101 which is pivoted at its center and has detents 102 at its ends either of which is engageable in longitudinal grooves 103 in the periphery of the drum, one of the pawl detents serving to impart rotation to the drum in one direction and the other in the opposite direction as best shown in Fig. 15. The pawl is yieldingly held in either of its positions by means of a spring pressed plunger 104 mounted in an arm 105 fixed to a pivot pin 106 journaled in the bell crank 90 so that it may be swung to engage the plunger with either of two shoulders 107 at opposite ends of the pawl.

Means is provided for automatically shifting the arm 105 to reverse the pawl 101 and thereby reverse the direction of rotation of the drum and this means consists of collars 108 secured upon opposite end portions of the drum and having stop pins 109 which engage with lateral arms 110 fixed to opposite ends of the pivot pin 106 to shift the same. As the drum rotates and moves laterally on the screw 95, one or the other of the arms 110 comes into circumferential alinement with a stop pin 109 and as the drum rotates, is engaged by the pin which swings the arm 105 and reverses the position of the pawl 101.

The drum is thus alternately rotated in one direction and then the other and reciprocated axially. At one end of the axial reciprocation of the drum, the pin 91 is engaged by the arm 93 shifting the trip pin 85 into the path of the tr lever 80 so that at one end of its stroke, the paw 78 is shifted into engagement with the ratchet to impart a relatively rapid movement to th feed drum 61. The rotative movement of th drum 94 is relatively slow with respect to the ra of movement of the oscillating pawl carrier so that the pin 85 will be held in tripping positio by the arm 93 a sufficient length of time to tri the pawl 78 but during the time in which th carrier 77 is making a complete oscillation, th arm 93 will have been moved to a position relea ing the pin 91 so that the trip pin 85 will be re turned by the spring 92 to its normal positio where it is engaged by the inclined face 89 of th trip lever and shifts the trip lever to the positio in which it holds the pawl 78 out of ratchet engag ing position.

Thus, upon a predetermined number of revolu tions of the operating shaft 50, the feed drum automatically advanced to provide a gap betwee the fastening elements applied to the strip s that there will be a predetermined number c fasteners closely and equally spaced along th strip and then a gap where the strip may b severed.

In order to vary the number of fasteners in group, the collars 108 may be adjusted longi tudinally of the drum 94 to increase or decreas the extent of axial movement of the drum an the number of rotations of the operating shaf between successive overrunning movements c the feed drum.

The machine of the present invention is adapt ed to operate efficiently at a very high rate c speed by reason of the fact that each fastene element is transferred to the tape and fixe thereto before another fastener element is sep arated from the metal stock. Furthermore, th fastener feed plunger and the clamping plunger are operated by very simple mechanical connec tions directly from the reciprocating head of th press so that the assembling and clamping opera tions are performed very rapidly and in exac timed relation to the movements of the hea In addition, the punching operations on th metal stock are kept very accurate by the posi tioning punch 17 which accurately alines th metal stock with respect to the punches and di openings upon each stroke of the press.

Furthermore, it is to be understood that th particular form of apparatus shown and de scribed, and the particular procedure set fort are presented for purposes of explanation an illustration and that various modifications of sai apparatus and procedure can be made withou departing from my invention as defined in th appended claims.

What I claim is:

1. A machine for forming fastener element and attaching the same to a strip and compris ing a bed, a reciprocating head moving towar and from the bed, means for intermittently feed ing metal stock across the bed beneath the head cooperating means carried by the bed and hea for forming fastener elements from said meta stock and separating the formed fastener ele ments one at a time from the stock, means fo supporting and feeding the strip, and mean actuated by said head for moving each fastene element as it is separated from the stock int engagement with the strip and for fastening th same to the strip.

2. A machine for forming fastener element and attaching the same to a strip and compris

g a bed, a reciprocating head moving toward id from the bed, cooperating means carried by d bed and head for forming fastener elements, guideway beneath the bed onto which the rmed fastener elements are delivered, means r supporting and feeding a strip across the d of said guideway, a plunger operated by said ad for moving the fastener elements into engagement with said strip, and means operated by d head for attaching the fastener elements to d strip.

3. A machine for forming fastener elements d attaching the same to a strip and comprisg a bed, a reciprocating head moving toward d from the bed, means for intermittently feedg metal stock across the bed beneath the head, uideway beneath the bed, means carried by the ad and bed for forming fastener elements from ld stock and for delivering a fastener element on each down stroke of the head into said ideway, means for supporting and feeding a rip across an end of the guideway, and means erating during each up stroke of the head to ove a fastener element along the complete ngth of said guideway into engagement with the rip and to attach the fastener element to the rip.

4. A machine for forming fastener elements and taching the same to a strip and comprising a d, a reciprocating head moving toward and om the bed, means for intermittently feeding etal stock across the bed beneath the head, a ideway beneath the bed, means carried by the ad and bed for forming from said stock fastener ements having spaced compressible jaws and for livering a fastener element upon each down roke of the head into the guideway, means for pporting and feeding a strip across an end of e guideway, a plunger in said guideway and eratively connected to the head for pushing ch fastener element into engagement with the rip with the jaws straddling the strip, and oposed plungers operatively connected to the head r pressing the jaws into clamping engagement th the strip.

5. A machine for forming fastener elements d attaching them to a strip and comprising a d, a vertically reciprocating head co-operating th the bed, means for intermittently feeding etal stock across the bed beneath the head, a ideway beneath the bed, means carried by the ad and bed for forming fastener elements from id stock and for delivering a fastener element to id guideway upon each down stroke of the head, eans for supporting and feeding a strip across end of the guideway, means operatively conected to the head for moving a fastener element ong the guideway into engagement with said rip upon each up stroke of the head, and means tuated by the head for attaching the fastener ements to the strip.

6. A machine for forming fastener elements d attaching them to a strip and comprising a d, a vertically reciprocating head co-operating ith the bed, means for intermittently feeding etal stock across the bed beneath the head, a ideway beneath the bed, means carried by the ad and bed for forming from said stock fastener ements having spaced compressible jaws and for livering a fastener element to the guideway on each down stroke of the head, means for pporting and feeding a corded tape across an d of the guideway, opposed plungers on opposite des of the tape, a plunger in said guideway for oving each fastener into a position between the opposed plungers with its jaws straddling the tape, and means for operating said opposed plungers during the intervals between successive down strokes of the head to engage the fasteners with the tape and clamp the same thereon.

7. A machine for forming fastener elements and attaching them to a strip and comprising a bed, a vertically reciprocating head co-operating with the bed, means for intermittently feeding metal stock across the bed beneath the head, a guideway beneath the bed, means carried by the head and bed for forming from said stock fastener elements having spaced compressible jaws and for delivering a fastener element to the guideway upon each down stroke of the head, means for supporting and feeding a corded tape across an end of the guideway, opposed plungers on opposite sides of the tape, a plunger in said guideway for moving each fastener into a position between the opposed plungers with the jaws straddling the tape, and means operatively connected with the head for actuating said plungers during each up stroke of the head to engage a fastener with the tape and clamp the same thereon.

8. A machine for forming fastener elements and attaching them to a strip comprising a bed, a vertically reciprocating head co-operating with the bed, means for intermittently feeding metal stock across the bed beneath the head, a guideway beneath the bed, means carried by the head and bed for forming from said stock fastener elements having spaced compressible jaws and for delivering a fastener element to the guideway upon each down stroke of the head, means for supporting and feeding a corded tape across an end of the guideway, opposed plungers on opposite sides of the tape, a plunger in said guideway for moving each fastener into a position between the opposed plungers with its jaws straddling the tape, means operatively connected to the head for operating the guideway plunger during the upstroke of the head, and separate means for operating said opposed plungers to compress the jaws of the fastener elements into clamping engagement with the tape.

9. A machine for forming fastener elements and attaching the same to a strip, comprising a bed, a vertically reciprocating head co-operating with the bed, a guideway beneath the bed, means for supporting and feeding a strip vertically across an end of the guideway and edgewise with respect thereto, means for intermittently feeding metal stock across the bed beneath the head, means carried by the head and bed for forming from said stock fastener elements having spaced compressible jaws and for delivering a fastener element to said guideway upon each down stroke of the head, a plunger in said guideway, opposed plungers on opposite sides of the strip, springs normally holding the latter plungers away from the strip, means operatively connecting the guideway plunger with the head for moving the same toward the strip during the up stroke of the head to shift a fastener element into a position in which its jaws straddle the strip, and wedge members movable with the head and acting upon the opposed plungers to simultaneously move them into engagement with the fastener jaws to compress the same into clamping engagement with the strip.

10. A machine for forming fastener elements and attaching the same to a strip, comprising a bed, a vertically reciprocating head co-operating with the bed, a guideway beneath the bed, means for supporting and feeding a strip vertically across

an end of the guideway and edgewise with respect thereto, means for intermittently feeding metal stock across the bed beneath the head punches carried by the head and bed for punching from said stock fastener elements having spaced compressible jaws and for delivering a fastener element to said guideway upon each down stroke of the head, a plunger in said guideway, opposite plungers on opposite sides of the strip, springs normally holding the latter plungers away from the strip, a bell crank lever mounted on a fixed pivot and having one arm yieldingly connected to the head and its other arm connected to the guideway plunger, and means operatively connecting the head with the opposed plungers for operating the same in opposition to their springs to compress the jaws into clamping engagement with the strip.

11. A machine for forming fastener elements and attaching the same to a strip, comprising a bed, a vertically reciprocating head co-operating with the bed, a guideway beneath the bed, means for supporting and feeding a strip vertically across an end of the guideway and edgewise with respect thereto, means for intermittently feeding metal stock across the bed beneath the head, means carried by the head and bed for forming from said stock fastener elements having spaced compressible jaws and for delivering a fastener element to said guideway upon each down stroke of the head, a plunger in said guideway, opposed plungers on opposite sides of the strip, springs normally holding the latter plungers away from the strip, a bell crank lever mounted on a fixed pivot and having one arm yieldingly connected to the head and its other arm connected to the guideway plunger, and wedge members movable with the head and acting on said opposed plungers to move the same toward the strip to compress the jaws into clamping engagement therewith.

12. In a machine of the character described, a guideway, means for supporting and feeding a strip across the guideway centrally thereof with the strip disposed edgewise to the guideway, fixed abutments at the end of the guideway on opposite sides of the strip, means for delivering to the guideway at predetermined intervals fastener elements having spaced compressible jaws presented toward the strip, means associated with the guideway for advancing each fastener element to a position in which its jaws straddle the strip and engage said abutments and for yieldingly holding the fastener element against said abutments, and means for compressing said jaws into clamping engagement with the strip while the fastener element is so held.

13. In a machine of the character described, a guideway, means for supporting and feeding a strip across the guideway centrally thereof with the strip disposed edgewise to the guideway, fixed abutments at the end of the guideway on opposite sides of the strip, means for delivering to the guideway at predetermined intervals fastener elements having spaced compressible jaws presented toward the strip, a plunger in the guideway for advancing the fasteners to strip engaging position, a reciprocating actuator having a yielding connection with said plunger whereby the fastener element is yieldingly held between said plunger and said abutments at the end of the stroke of the plunger, and means for compressing said jaws into clamping engagement with the strip while the fastener element is yieldingly held against said abutments.

14. In a machine for affixing fastener elements to a strip, means for feeding the strip including a feed drum, a ratchet through which the drum is driven, a rotatable member having a pawl engaging said ratchet, means for continuously rotating said member, means independent of the pawl and ratchet for turning the drum in the direction in which it is turned by the pawl and ratchet, but at a higher speed, and means for intermittently actuating the last mentioned means, said actuating means being adjustable for varying the intervals between actuations thereof.

15. In a machine for affixing fastener elements to a strip, a drive shaft, fastener forming and affixing means operated by said shaft, means for feeding a strip past the affixing means including a feed drum, means including a pawl and ratchet for driving said drum at a uniform speed from said shaft, a second ratchet rotatable with said drum, a pawl mounted to swing about the axis of said second ratchet and engageable therewith, means operated by said drive shaft for oscillating the last mentioned pawl, means for normally holding said pawl out of engagement with said second ratchet, and means operated by said shaft for periodically engaging said pawl with said ratchet.

16. In a machine for affixing fastener elements to a strip, a drive shaft, fastener forming and affixing means operated by said shaft, means for feeding a strip past the affixing means including a feed drum, means including a pawl and ratchet for driving said drum at a uniform speed from said shaft, a second ratchet rotatable with said drum, a pawl mounted to swing about the axis of said second ratchet and engageable therewith, means operated by said drive shaft for oscillating the last mentioned pawl, means for normally holding said pawl out of engagement with said second ratchet, and means operated by said shaft for periodically engaging said pawl with said ratchet, said last mentioned means being adjustable to vary the intervals between actuations of said second ratchet by said pawl.

17. In a machine for affixing fastener elements to a strip, a drive shaft, fastener forming and affixing means operated by said shaft, means for feeding a strip past the affixing means including a feed drum, means including a pawl and ratchet for driving said drum at a uniform speed from said shaft, a second ratchet rotatable with said drum, a pawl mounted to swing about the axis of said second ratchet and engageable therewith, means operated by said drive shaft for oscillating the last mentioned pawl, means for normally holding said pawl out of engagement with said second ratchet, a fixed threaded member, a rotatable member in threaded engagement therewith, means operated by said shaft for rotating the latter member to advance the same on said first threaded member, means operable at predetermined intervals for reversing the direction of movement of the rotatable member, and means carried by the rotatable member for periodically engaging said pawl with said second ratchet.

18. In a machine of the character described, a drive shaft, a feed drum, a ratchet having a driving connection with said drum, a rotatable member mounted coaxially with said ratchet, a pawl carried by said rotatable member and engaging said ratchet, a driving connection between said drive shaft and rotatable member for continuously rotating the latter, and means periodi-

cally operated by said drive shaft for imparting to the drum a rotative movement at a speed in excess of that of said rotatable member, said last mentioned means being adjustable to vary the intervals between actuations of the drum thereby.

19. In a machine of the character described, a drive shaft, a feed drum, a ratchet having a driving connection with said drum, a rotatable member mounted coaxially with said ratchet, a pawl carried by said rotatable member and engaging said ratchet, a driving connection between said drive shaft and rotatable member for continuously rotating the latter, a second ratchet having a driving connection with said drum, a member mounted to swing about the axis of said second ratchet, means operated by said drive shaft for oscillating the latter member, a pawl carried by said member and engageable with said ratchet, means for normally holding the latter pawl out of engagement with the ratchet, and means operated by said drive shaft for periodically engaging said pawl with its ratchet.

20. In a machine of the character described, a drive shaft, a feed drum, a ratchet having a driving connection with said drum, a rotatable member mounted coaxially with said ratchet, a pawl carried by said rotatable member and engaging said ratchet, a driving connection between said drive shaft and rotatable member for continuously rotating the latter, a second ratchet having a driving connection with said drum, a member mounted to swing about the axis of said second ratchet, means operated by said drive shaft for oscillating the latter member, a pawl carried by said member and engageable with said ratchet, means for normally holding the latter pawl out of engagement with the ratchet, and means operated by said drive shaft for periodically engaging said pawl with its ratchet said last mentioned means being adjustable to vary the time intervals between actuations of the drum by the second pawl and ratchet.

21. The method of forming fastener elements of the type having spaced clamping jaws at one end and an interlocking projection and recess at the other end, including feeding a flat piece of metal, forming said projection and recess, cutting out portions to provide spaces between the clamping jaws of each element and afterwards severing the elements from the strip, said cutting out and severing being performed in separate operations.

22. The method of making a fastener stringer of the type having a flexible strip and fastener elements attached to said strip by clamping jaws at one end comprising forming interlocking projections and recesses in a flat strip of material, punching out material adjacent said recesses to provide spaces between the clamping jaws of the fastener elements when separated from the strip, severing the elements from the strip in a succeeding operation and attaching said fastener elements to the flexible strips at spaced intervals.

23. The method of forming fastener elements each having a recess and projection at one end and separated clamping jaws at the other end and attaching such elements to a strip comprising forming recesses and projections in said strip at spaced intervals, successively positioning said recesses and projections under a blanking punch and blanking out elements each of which includes a recess and projection, transferring said elements, one at a time, to a carrier strip, and pressing the jaws of said element together to clamp the same around the edge of said strip.

24. The method of forming fastener elements each having a recess and projection at one end and separated clamping jaws at the other end and attaching such elements to a stringer comprising feeding a flat strip of material, forming aligned recesses and projections in said strip of material, positioning said recesses and projections in turn under a blanking punch and successively blanking out elements from said strip each of which includes a recess and projection and jaws extending cross-wise of the strip, transferring said elements, one at a time, into attaching position with the clamping jaws astride a carrier strip and bending said jaws together to clamp the elements to said strip.

25. The method of making a fastener stringer of the type having a flexible strip and fastener elements attached in spaced relation to the edge of said strip comprising feeding a strip of metal, forming interlocking projections and recesses therein and punching out elements therefrom, each of which includes a projection and recess and shaped to provide separated clamping jaws at one end, feeding a fabric strip wholly out of the line of said metal feed, transferring the elements as punched from the metal strip to the fabric strip and positioning the same thereon with the jaw end astride the edge of the strip and clamping said jaws to the strip.

26. A machine for securing fastener elements to a supporting tape comprising continuously operable feeding means for feeding the tape under tension, fastener element clamping mechanism spaced from the feeding means for clamping the fastener elements to the tape, said element clamping mechanism being stationary whereby movement of the tape at the clamping station is temporarily arrested by the fastener element being clamped without arresting operation of said feeding means.

27. In a machine for affixing fastener elements to a strip, continuously operable feeding means for feeding the strip under tension continuously including a feed drum, means for normally driving said drum at a continuous uniform speed, means for periodically increasing the speed of rotation of the drum to provide gaps between groups of fastener elements on the tape, and means for intermittently feeding fastener elements to a position astride the edge of said strip and clamping them in position thereon.

GIDEON SUNDBACK.

DEFENDANT'S EXHIBIT "G"

L. W. Smith Patent No. 1,533,352

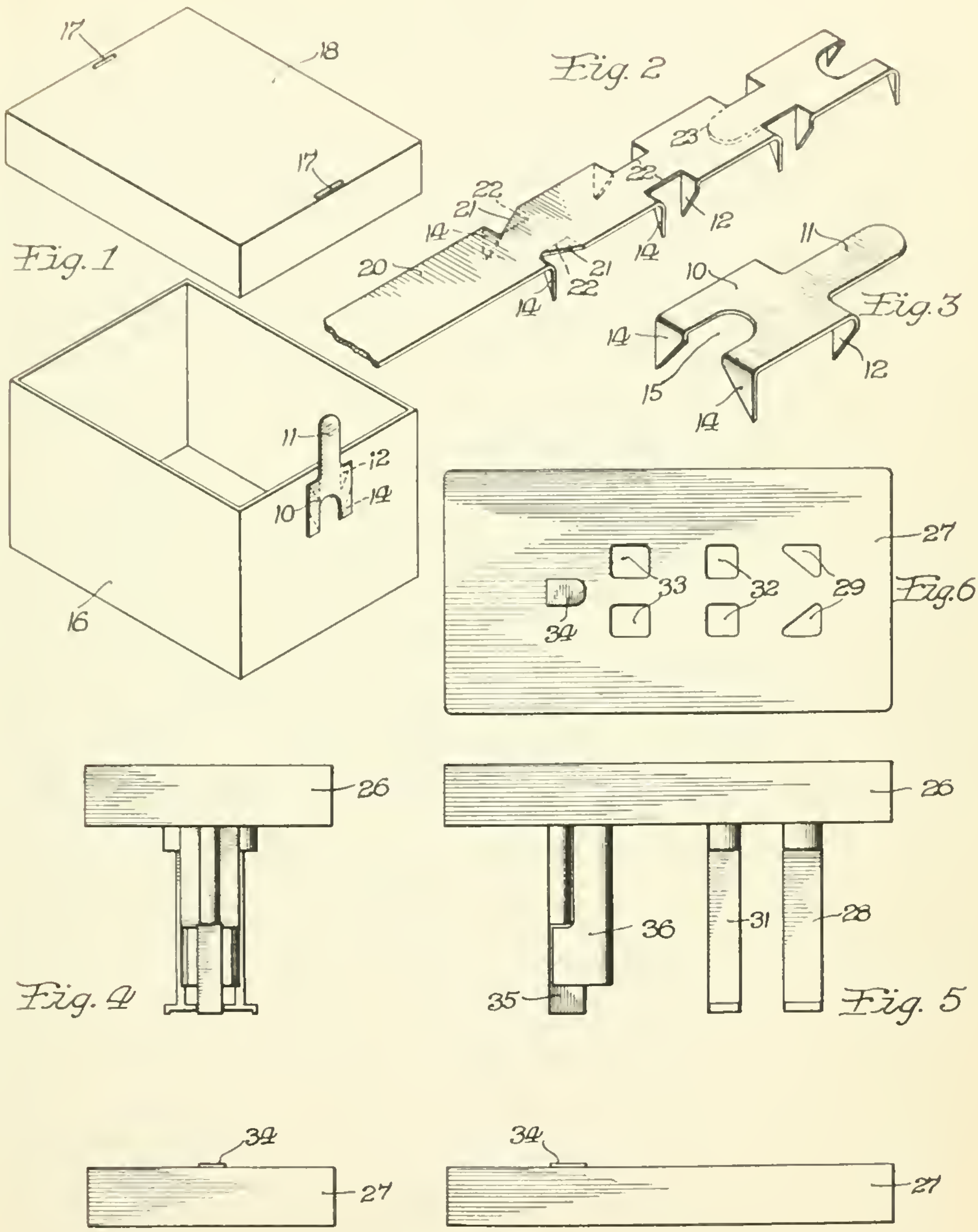
Filed Aug. 3, 1920 Patented April 14, 1925

April 14, 1925. 1,533,352

L. W. SMITH

METHOD OF MAKING PAPER BOX FASTENERS

Filed Aug. 3, 1920



Inventor
Lou W. Smith
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UNITED STATES PATENT OFFICE.

LOU W. SMITH, OF CHICAGO, ILLINOIS.

METHOD OF MAKING PAPER-BOX FASTENERS.

Application filed August 3, 1920. Serial No. 401,036.

To all whom it may concern:

Be it known that I, Lou W. Smith, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Methods of Making Paper-Box Fasteners, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings forming a part of this specification.

My invention relates to an improved method of making paper box fasteners and the like.

The primary object of my invention is to provide an improved method of manufacturing a simple and inexpensive form of box fastener which will have maximum security of engagement with the wall of the paper box; this being accomplished by devising the body portion thereof to have a comparatively large area of clenched engagement with the wall of the box by the provision of a plurality of clenching prongs on the body portion at points so distributed as to sustain the lateral and outward strains to which the fastener is subjected, without danger of tearing from the box.

This improved method is designed to punch out these fasteners with maximum rapidity and with perfect economy of material, this latter result being attained by punching the fasteners out of the stock material in such a manner as to utilize every bit of stock and avoid the creation of any waste scrap.

In the accompanying drawings in which a preferred embodiment of my invention is particularly illustrated:

Figure 1 is a perspective view of a paper box illustrating the application of one of my improved fasteners;

Fig. 2 is a perspective view of the stock material illustrating in progressive sequence the various punching operations performed thereon;

Fig. 3 is an enlarged perspective view of the completed fastener;

Fig. 4 is a simplified end view of the punching dies for performing the punching operations;

Fig. 5 is a side view of the same; and

Fig. 6 is a plan view of the die plate.

Referring to the perspective illustration in Fig. 3, my improved box fastener comprises a body portion 10 and an extending tongue 11. The tongue 11 is made considerably narrower than the body portion 10, forming an upper edge on the body portion from which are bent down two prongs or spurs 12—12. These prongs are of triangular formation, being struck down from the metal along the lateral edges of the tongue 11 in such a manner as to form vertical inner edges on the prongs and inclined outer edges which converge inwardly and form points on the prongs. The lower end of the fastener is similarly formed with two triangular prongs 14—14. The outer edges of these prongs 14 extend vertically, or at a right angle to the body of the fastener, while the inner edges extend diagonally thereto to form the points. It will be noticed that the lower edge of the body portion 10 is formed with an upwardly extending recess 15. As I shall hereinafter describe in connection with the punching operation, this recess results from punching the tongue end of the preceding fastener out of the body portion of the next adjacent fastener. This practice does not impair the strength of the body portion 10 or prongs 14 to any extent, and has the advantage of saving a considerable quantity of metal.

Fig. 1 illustrates a typical application of my improved type of fastener to a paper box. The fasteners are secured to the end walls of the box 16 by forcing the prongs 12 and 14 through the wall of the box from the outside and clenching over the inner projecting ends on the inside of the box. The provision of the four prongs 12—12 and 14—14 at the four corners of the fastener insures a distributed area of engagement of the fastener with the wall of the box and assures a firmer mounting of the fastener on the box. The four-point fastening prevents lateral as well as inward and outward bending strains from loosening the fastener and thus securely holds the fastener against such strains as will generally tend to loosen a two-prong fastener. The fasteners are preferably situated adjacent the upper edge of the wall of the box, so that the tongues 11 thereof will be in position to pass through slotted openings 17 in the ends of the box 18. With the box cover 18 in position, the projecting ends of the tongues 11 are bent down upon the cover, either along the top or down across the ends, in an obvious manner.

In Fig. 2 I have illustrated the successive punching operations involved in the manufacture of these fasteners; and it will be noted from this figure that the stock material is in the form of strip metal of exactly the same width as that of the finished fastener. The first operation to be performed on the stock strip 20 is the punching of two diagonal incisions 21 on opposite sides of the strip, and simultaneously therewith, or subsequently, bending the triangular portions of metal formed by the acute angles of the incisions downwardly on each side of the strip and thereby forming the triangular prongs 14—14. After the cutting of these two incisions 21—21 and the bending downward of the prongs 14, which operations are preferably performed as a simultaneous operation, the stock strip 20 is fed forwardly (which is to the right as illustrated in Fig. 2) to place the diagonal incisions 21 under the punching tools which perform the next operation. This latter operation is to make two incisions 22—22 which extend substantially longitudinally from the innermost ends of the diagonal incisions 21—21, as indicated by the dotted lines at the first step and by the full lines at the second step. These longitudinal incisions 22 are preferably extended back to a point approximately even with the outer ends of the diagonal incisions 21; it will of course be obvious that these longitudinal incisions may be inclined inwardly or outwardly from a true longitudinal line for the purpose of making wider or narrower prongs, if desired. The cutting punch is preferably so designed that simultaneously with the cutting of these longitudinal incisions 22, the triangular portions of metal between the diagonal and longitudinal incisions will be bent downwardly to form the triangular prongs 12. After the performance of this operation the stock strip 20 is again advanced to place the portion of strip previously operated upon under the die which punches out the tongue 11. As indicated by the dotted line 23, the outer end of the tongue 11 is preferably punched out of the end of the next succeeding fastener. This is the preferred practice inasmuch as it provides a relatively long tongue 11 for affording greater security of fastening when engaging over the box cover. It will be noted, however, that a relatively large portion of the tongue 11 is defined between the longitudinal incisions 22, and as an alternative construction, I may separate the fasteners by cutting across this neck of metal at either end of the longitudinal incisions so as to utilize this extending neck of metal as the tongue. The present practice of continuing the tongue up into the body of the next succeeding fastener is however preferred. The tongue may of course be reversed by punching it out of the preceding instead of the succeeding fastener, in which event the tongue would extend forwardly of each finished fastener discharged from the machine. The punching out of the tongue 11 separates the fasteners, after which the completed fasteners are clenched to the end walls of the paper box, either as a subsequent operation performed by the same die head or as an independent operation.

In Figs. 4, 5 and 6, I have illustrated in a simplified showing the die mechanisms for performing these punching operations. A vertically reciprocating die head 26 carries on its under side the several male dies which are adapted to cooperate with a female die or die plate 27. The stock strip 20 is fed intermittently from right to left between the dies and the die plate during the reciprocation of the dies, suitable guide mechanism (not shown) being provided for guiding the strip in operative association with the dies. A first pair of dies 28 performs the simultaneous operation of cutting the diagonal incisions 21—21 and bending the triangular prongs 14 downwardly out of the intervening portions of metal. These dies 28 cooperate with triangular die openings in the die plate 27, into which the prongs 14 are bent. Subsequent to this operation the strip is raised and advanced forwardly to position the notched portion of the strip directly under a second pair of dies 31. This latter pair of dies cooperate with a pair of substantially square die openings 32 in the die plate 27, along the margins of which the dies 31 shear the longitudinal incisions 22 and fold down the triangular prongs 12—12. The next operation is performed by raising the strip and advancing it forwardly to position the two pairs of prongs 12 and 14 in register with a second pair of rectangular openings 33 in the die plate 27. This locates the outer or lower end of the fastener directly over a small male die 34 in the die plate 27, which male die 34 is conformed to punch out the pointed tip of the tongue 11 from the outer end of the outermost fastener unit. Cooperating with the die 34 is a spring pressed plunger 35, which is shaped similarly to the die 34 and which is embraced by a female die member 36 which is adapted to move down over the margins of the male die 34 and perform the operation of punching out the end of the tongue 11. In the performance of this latter punching operation, it will be noticed that the adjacent pairs of prongs 12 and 14 are thrust downwardly into the pair of openings 33 and are thus prevented from being turned over or injured. The fasteners may be secured directly to the body of the box at this point or may be discharged into a hopper for packing.

It will be noticed from the foregoing that the gang arrangement of the dies performs the three punching operations at different points on the stock strip upon each reciprocation of the die head, and as a result the punching out of the completed fasteners follows as a continuous operation. It will also be noted that as a result of the present formation of fastener and the improved method of making the same there is an entire elimination of waste scrap metal.

I claim:

1. The method of constructing box fasteners out of a continuous strip of metal which comprises making lateral incisions in the edge of the strip and punching prongs for said fasteners by folding backwardly the metal adjacent said lateral incisions, and punching tongues on said fasteners from substantially the entire metal between said lateral incisions.

2. The method of constructing box fasteners out of a continuous strip of metal which comprises cutting lateral incisions along each edge of the strip and punching prongs for said fasteners by bending downwardly the metal adjacent said lateral incisions, and forming tongues on said fasteners by punching the same out of the adjacent fasteners and from substantially the entire metal between said lateral incisions.

3. The method of constructing box fasteners out of a continuous strip of metal which comprises making a diagonal incision along each edge of the strip, bending the metal backwardly on a line passing through the end of said incision to form a spur or prong, cutting a substantially longitudinal incision extending from the diagonal incision, bending the intervening metal backwardly to form a second prong, and punching a tongue for each fastener out of the intervening metal between the incisions on opposite sides of the strip.

4. The method of constructing box fasteners out of a continuous strip of metal which comprises cutting a diagonal incision along each edge of the strip, bending the metal backwardly on a line passing through the end of said diagonal incisions to form spurs or prongs, cutting substantially longitudinal incisions extending from the ends of said diagonal incisions, and bending the intervening metal between said incisions backwardly to form secondary spurs or prongs.

In witness whereof I hereunto subscribe my name this 31st day of July, 1920.

LOU W. SMITH.

DEFENDANT'S EXHIBIT "H"

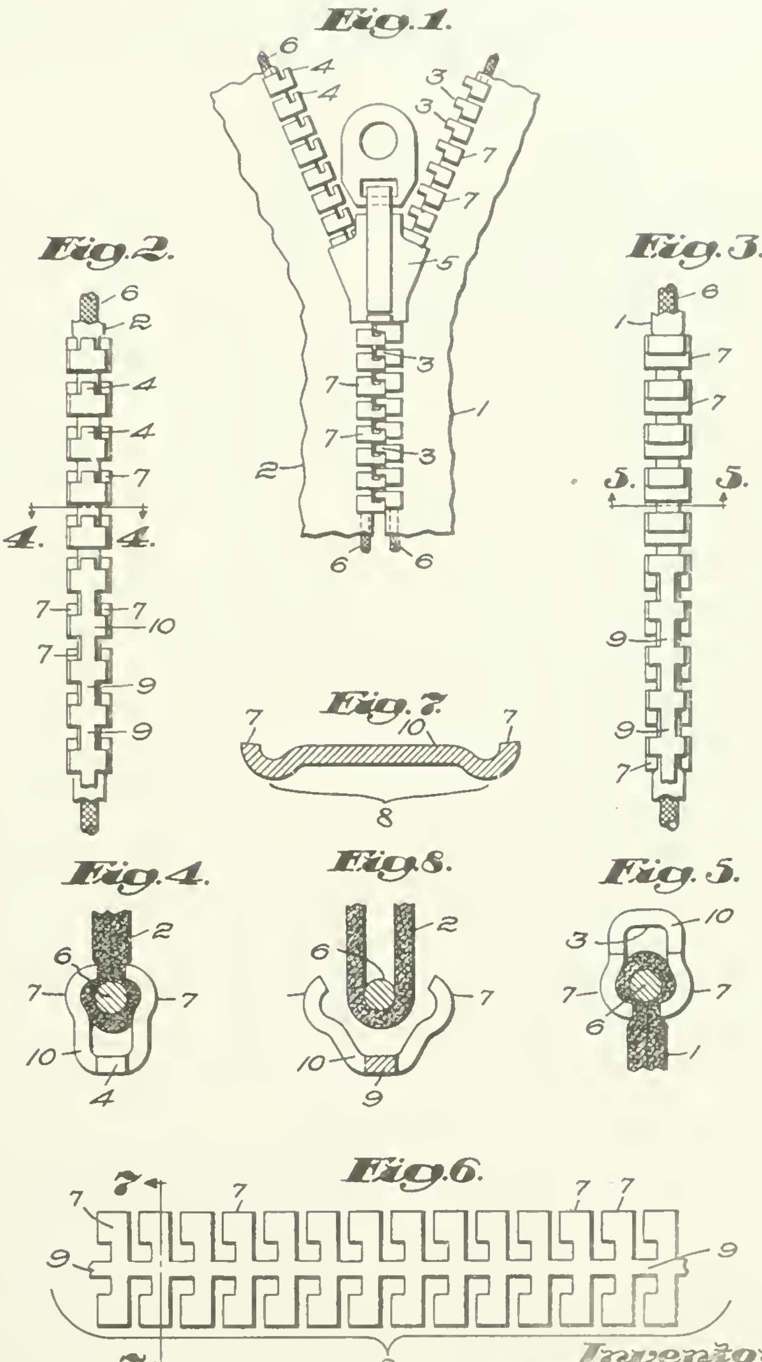
G. Johnson Patent No. 1,731,667

Filed Jan. 27, 1928 Patented Oct. 15, 1929

Oct. 15, 1929. G. JOHNSON 1,731,667

METHOD OF MAKING AND ATTACHING FASTENER ELEMENTS

Filed Jan. 27, 1928



Inventor:
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by Emery, Booth, Janney + Varney
Attys

Patented Oct. 15, 1929 1,731,667

UNITED STATES PATENT OFFICE

GUSTAV JOHNSON, OF WEST ROXBURY, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNITED-CARR FASTENER CORPORATION, OF CAMBRIDGE, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

METHOD OF MAKING AND ATTACHING FASTENER ELEMENTS

Application filed January 27, 1928. Serial No. 249,851.

My invention aims to provide improvements in the method of making and attaching a series of fastener elements to a stringer or tape.

In the drawings, which illustrate a preferred embodiment of the invention:—

Figure 1 is a view showing a portion of each of two stringers located at the opening in a part to be closed by the fastener elements secured to the edges of the stringers and also a slider for connecting and disconnecting the fastener elements;

Fig. 2 is an edge view of a stringer carrying stud or hook members of the fastener elements, and showing the method of severing the connecting portions to make the stud or hook members after the fastener members have been attached in a strip to one edge of the stringer;

Fig. 3 is a view similar to Fig. 2, but showing sockets or eyelets and the method of attaching and securing the same;

Fig. 4 is a cross-section taken on the line 4—4 of Fig. 2 showing only a portion of the stringer in cross-section;

Fig. 5 is a section on the line 5—5 of Fig. 3;

Fig. 6 is a plan of a portion of a strip of the fastening elements before they are attached and showing how they are connected;

Fig. 7 is a cross-section on the line 7—7 of Fig. 6 showing the curved attaching portions; and

Fig. 8 is a section showing a stringer with the strip bent up and about to be clamped to the stringer.

Referring to the embodiment of my invention shown by the drawings, I have illustrated fastening means particularly adapted for various articles having an opening which must be opened and closed. For this purpose, I have shown (Fig. 1) two stringers 1 and 2 of suitable material to be attached to the article which is to be provided with the fastening means. The stringer 1, shown at the right of Fig. 1, is provided, along one edge, with a series of sockets or eyes 3 more fully hereinafter described. The stringer 2 at the left of the figure is provided with a series of studs or hooks 4 constructed as hereinafter described.

A suitable slider 5, constructed to engage the fastening elements 3 and 4 and to slide relative thereto, for engaging and disengaging the fastener elements is indicated in a general way in Fig. 1. The construction and operation of a slider for this purpose is so well-known to those skilled in the art as to make it unnecessary to go into further detail in connection therewith.

The stringers 1 and 2 may be of any suitable construction but, for the purposes of illustration, I have shown them as being made of flexible material which is doubled (Figs. 4 and 5) to provide a rounded edge to which the fastener elements are secured. A cord 6 is inserted at the rounded edge so as to form a bead to cooperate with the attaching portions 7 of the fastening elements to prevent the fastening elements from being pulled loose when under lateral stresses.

Any suitable machine may be used to form the strip 8 of fastening elements, shown in Fig. 6, therefore, it is unnecessary to go into detail in illustrating and describing a machine for this purpose. It will be readily understood, by persons skilled in the art, that, by passing a strip of metal, between suitable dies, portions of the strip 8 may be cut out along each edge, as indicated in Fig. 6.

The strip 8, shown in Fig. 6, is provided, along its longitudinal edges, with the attaching portions 7, and between the attaching portions 7 are the fastener portions and the connecting portions 9. It should be understood that the strip 8 may be made into either a series of socket or eye-shaped elements 3 or a series of studs or hooks 4 as desired depending upon how much of the connecting portions 9 is removed.

The strip 8 may be formed and attached in any suitable manner but for the purposes of illustration I have shown (Fig. 7) the attaching portions 7 as being first curved in cross-section to fit the curve of the beaded portion of a stringer. The strip is thereafter pressed into the form shown in Fig. 8 and it is only necessary to press the attaching portions 7 against opposite sides of a stringer at one edge to secure it firmly thereto, as shown in Figs. 4 and 5. When a strip

8 is attached to a stringer the fastening portions extend from one edge in the form of loops 10 (Figs. 4 and 5) to provide the eyes 3 or to support the hooks 4 as the case may be.

The object of forming the fastener elements in strips is to provide for accurate spacing of the fastener elements upon the part which carries them so that they will make positive engagement with cooperating fastener elements with the least possible amount of effort when the slider 5 is moved along the two rows of fastener elements. This method of attachment is also very simple and the fastener elements are very easy to handle when provided in strips.

Another important reason for providing the fastener elements in strips, when formed as illustrated and described, is that a strip may be made into a series of separate sockets or eyes or studs or hooks as desired. By cutting away all of each of the connecting portions 9, as shown in Figs. 3 and 5, a series of sockets or eyes 3 is provided. If, however, as shown in Figs. 2 and 4, a portion of each of the connecting portions 9 is left so that it extends from the loop 10, a series of studs or hooks 4 is provided for cooperative engagement with the loops 3. (Note that in Figs. 2 and 3 some of the fastener elements have been cut apart while the others remain in strip form to illustrate my method of attaching the fasteners in strip form and then cutting them apart so that they may be free to act independently of each other.) Any suitable mechanism may be used to sever the connecting portions 9 and they may be cut apart by hand or automatically by machine, as by sawing, milling or punching.

I am aware that my invention may be embodied in forms other than that shown and described without departing from the scope of my invention and, therefore, reference is made to the following claims to indicate the scope of my invention.

Claims:

1. The method of making fastener elements adapted to be secured to a stringer which comprises forming the fastener elements in a strip with connecting means between each fastener element, fastening the strip to a stringer and then severing the connecting means to provide a series of independent fastener elements which may be engaged with cooperating fastener elements on another stringer.

2. The method of making fastener elements adapted to be secured to a stringer which comprises forming the fastener elements in a flat strip with connecting means between each fastener element bending the strip to form a series of loops, attaching the bent strip to one edge of a stringer and then cutting the fastener elements apart at the connecting means to provide a series of independent fastener elements which may be free to cooperate with other fastener elements on another stringer.

3. The method of making a fastening device including a stringer and a series of uniformly spaced fastening elements attached to the stringer which comprises pressing the fastener elements from a strip of metal, leaving connecting portions between the fastener elements so that they may be attached to the stringer in a strip to secure uniform spacing, bending the strip and attaching it to one edge of the stringer and then severing the connecting portions to provide a series of independent fastener elements which may yield with the stringer for engagement with cooperating fastener elements carried by another stringer.

4. The method of making a fastening device including a stringer and a series of uniformly spaced fastening elements attached to the stringer which comprises pressing the fastener elements from a strip of metal, leaving connecting portions between the fastener elements so that they may be attached to the stringer in a strip to secure uniform spacing, bending the strip and attaching it to one edge of the stringer and then cutting away a portion of or all of each connecting portion to provide for a series of eye-shaped fastening elements or hook-shaped fastening elements as desired.

5. The method of making a fastening device including a stringer and a series of uniformly spaced fastening elements attached to the stringer which comprises pressing the fastener elements from a strip of metal, leaving connecting portions between the fastener elements so that they may be attached to the stringer in a strip to secure uniform spacing, bending the strip and attaching it to one edge of the stringer and then cutting away all of each of the connecting portions to provide a series of spaced eyes.

6. The method of making a fastening device including a stringer and a series of uniformly spaced fastening elements attached to the stringer which comprises pressing the fastener elements from a strip of metal, leaving connecting portions between the fastener elements so that they may be attached to the stringer in a strip to secure uniform spacing, bending the strip and attaching it to one edge of the stringer and then cutting away a portion of each of the connecting portions and leaving a portion of each to provide a series of hooks.

7. The method of making fastening means including a stringer and a series of spaced fastening elements, the fastening elements having attaching portions and fastener-engaging portions which comprises providing the fastening elements in a strip provided with connecting portions between the fastener-engaging portions, securing the strip to one edge of the stringer and severing the strip at the connecting portions.

8. The method of making fastening means ıcluding a stringer and a series of spaced astening elements, the fastening elements aving attaching portions and fastener-enaging portions, which comprises pressing a trip of metal to provide fastening portions t the center, attaching portions at the sides nd connecting portions between the fasten-ıg portions, attaching the pressed strip to ne edge of the stringer and then cutting the astening portions apart at the connecting ortions.

9. The method of making and attaching a eries of fastener elements to a stringer which omprises forming the fastener elements in strip 8, bending and attaching the strip to he stringer by means of the attaching porions 7 and then cutting away all or portions f connecting means 9 which hold the fastener lements together prior to and while being atached to a stringer.

10. A blank having a series of fastener eleıents for attachment to a stringer, said blank ıaving attaching means at its opposite edges or securing the blank to one edge of a tringer, means along the center of the blank dapted to provide fastening elements for ooperation with other fastening elements nd connecting means normally holding all f the fastening elements together but being emovable to separate the fastening elements fter the blank has been attached to a stringer.

In testimony whereof, I have signed my ıame to this specification.

GUSTAV JOHNSON.

DEFENDANT'S EXHIBIT "I"

L. Hommel Patent No. 1,659,266

Filed Dec. 31, 1924 Patented Feb. 14, 1928

Feb. 14, 1928. 1,659,266

L. HOMMEL

MACHINE FOR MAKING METAL FASTENERS AND THE LIKE

Filed Dec. 31, 1924 5 Sheets-Sheet 1

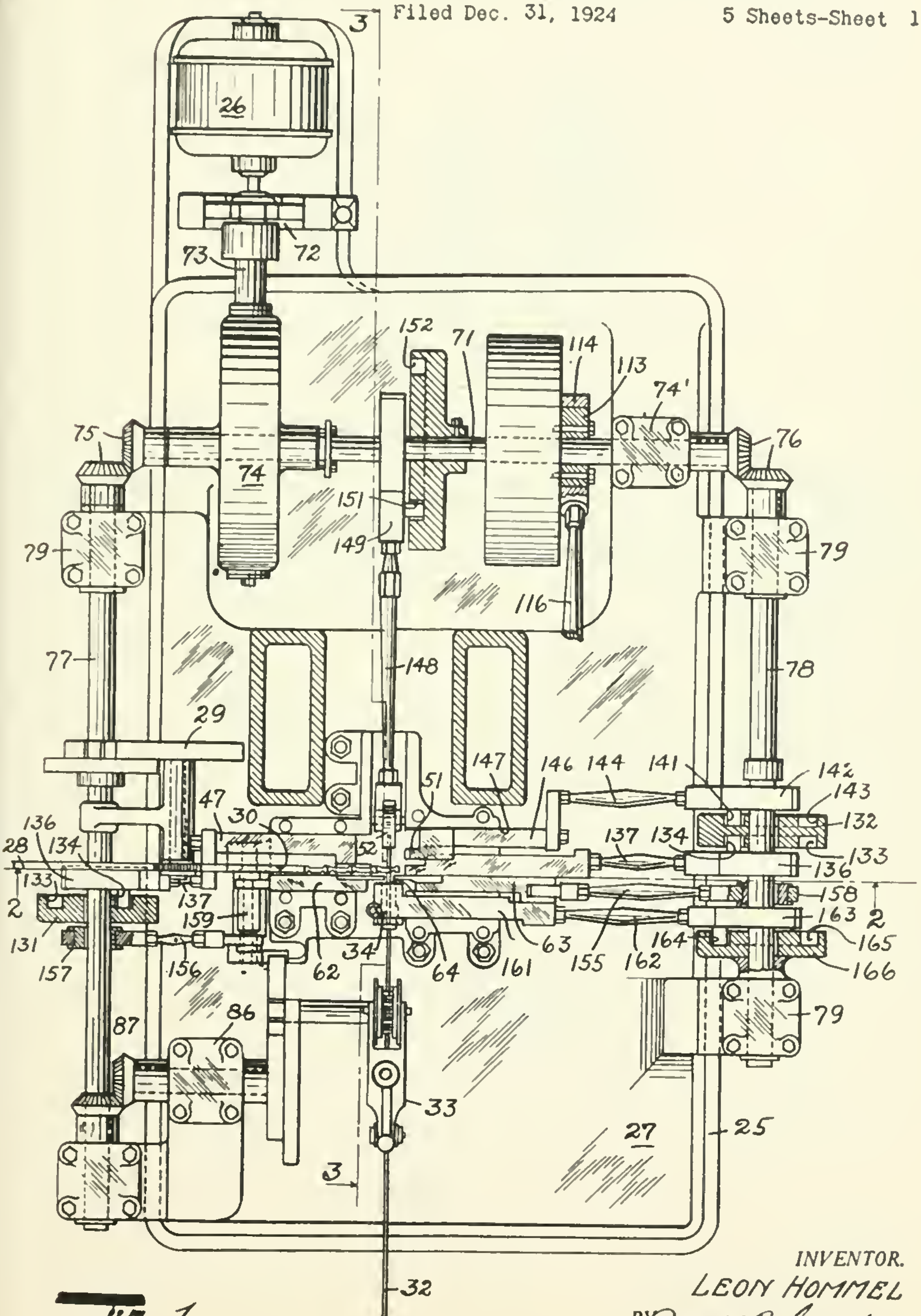

Fig. 1

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MACHINE FOR MAKING METAL FASTENERS AND THE LIKE

Filed Dec. 31, 1924 5 Sheets-Sheet 2

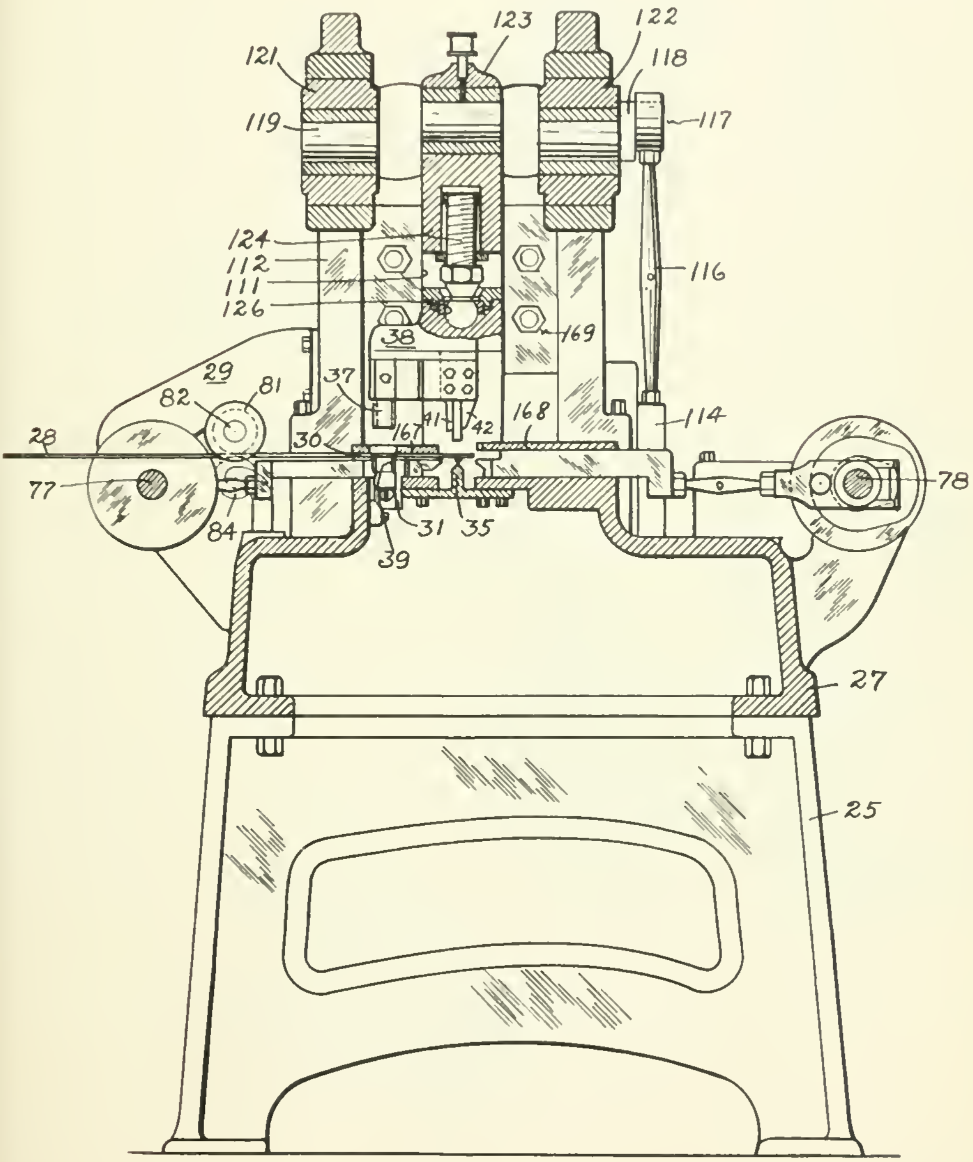

Fig. 2

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MACHINE FOR MAKING METAL FASTENERS AND THE LIKE

Filed Dec. 31, 1924 5 Sheets-Sheet 3

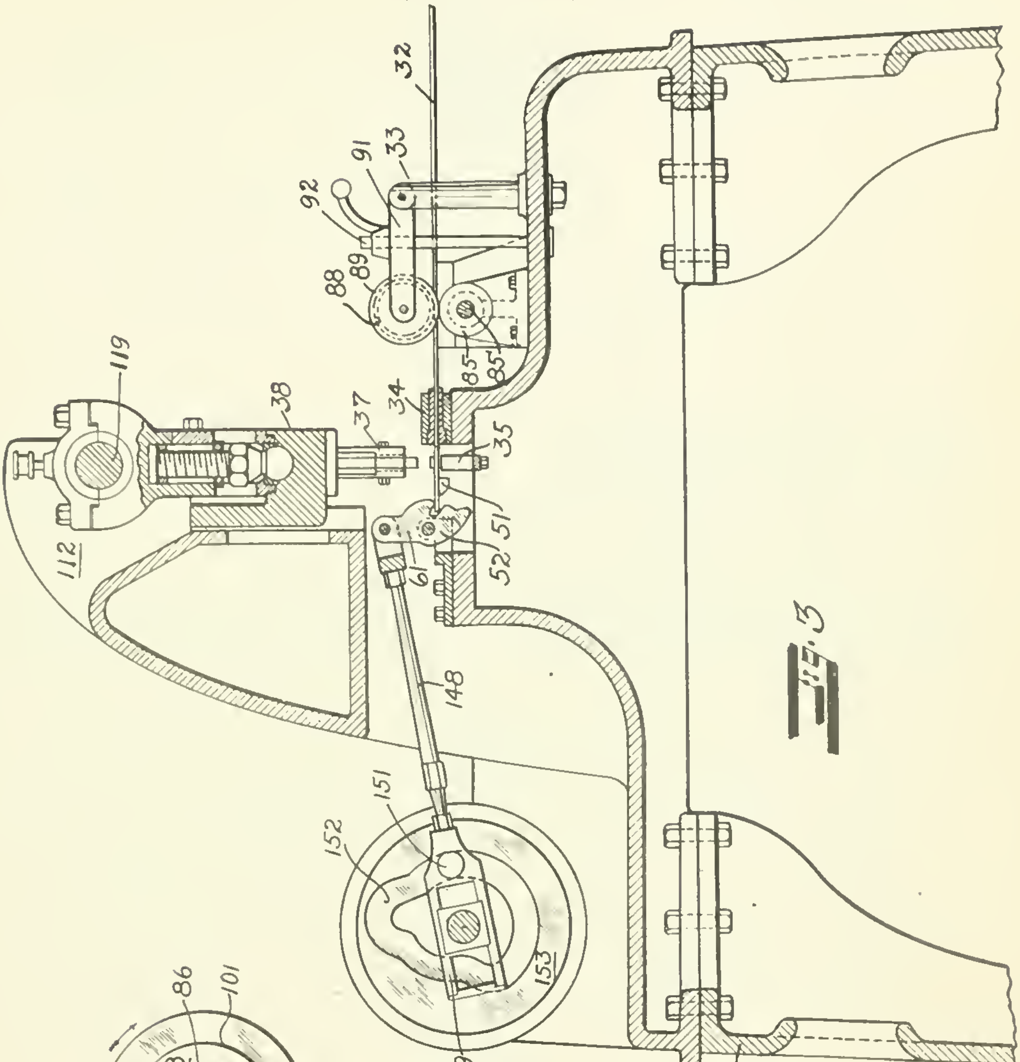

Fig. 3

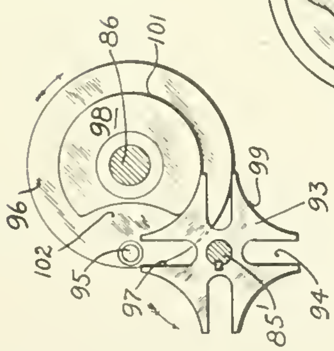

Fig. 4

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MACHINE FOR MAKING METAL FASTENERS AND THE LIKE

Filed Dec. 31, 1924 5 Sheets-Sheet 4

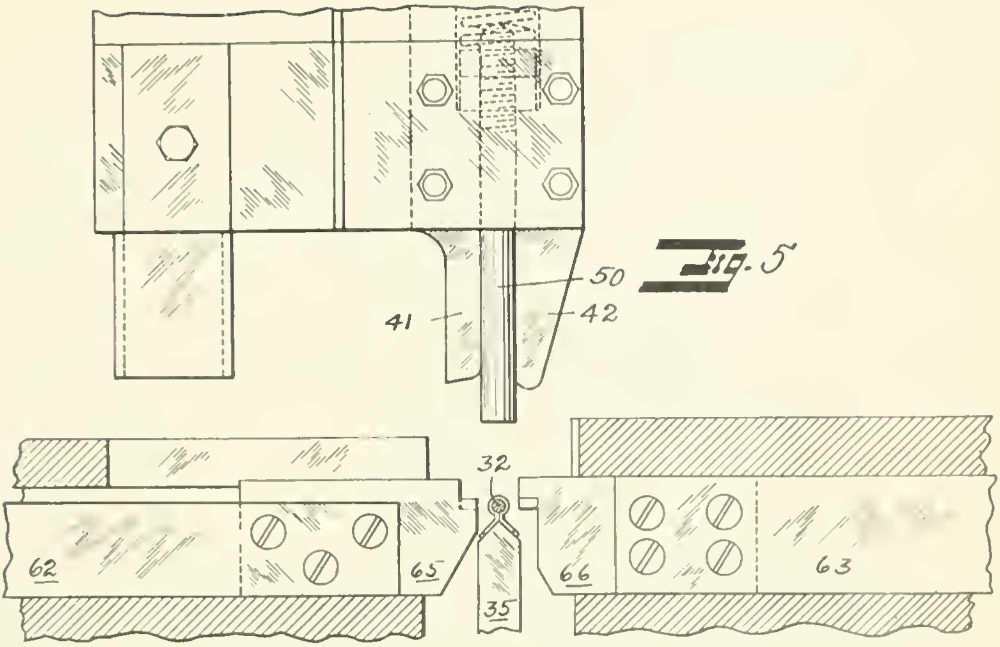

Fig. 5

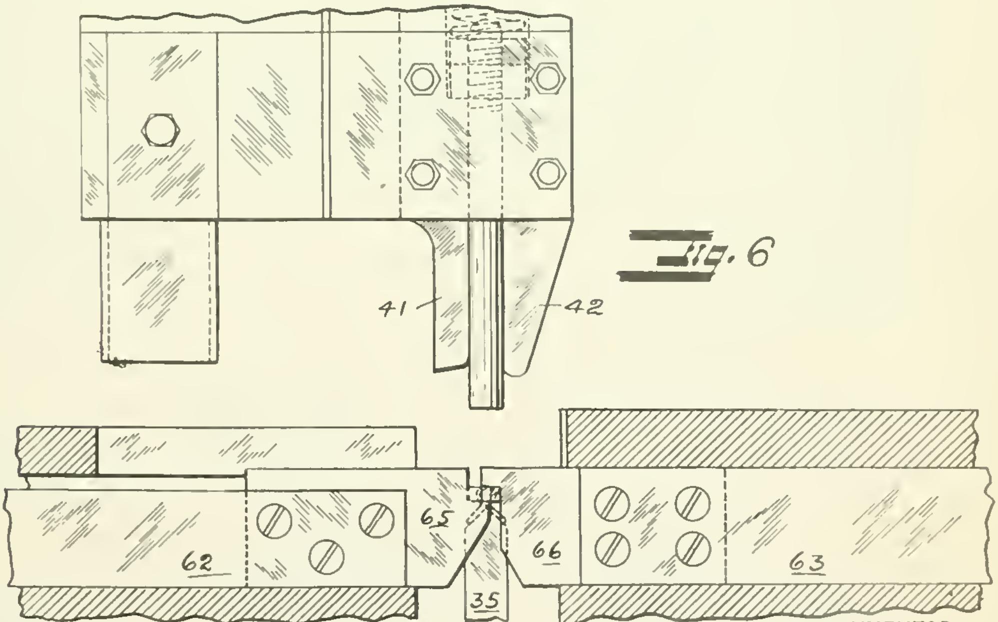

Fig. 6

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L. HOMMEL

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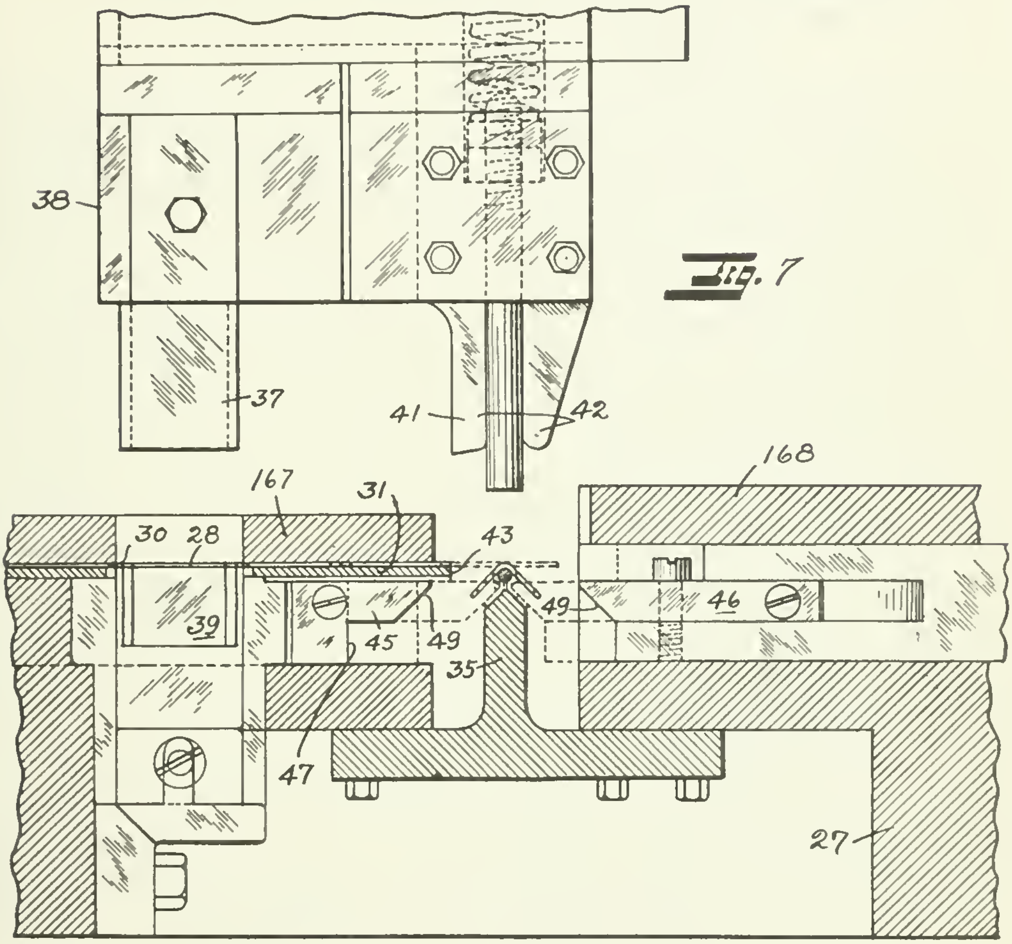

Fig. 7

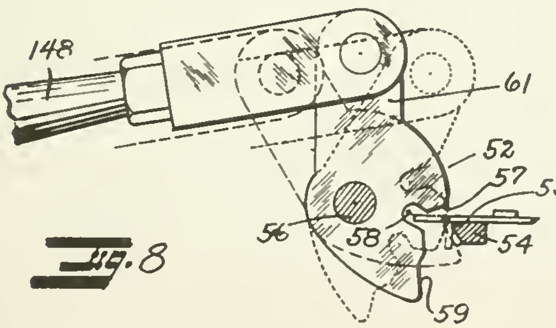

Fig. 8

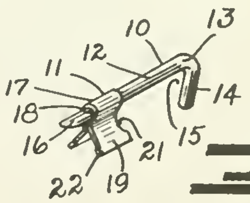

Fig. 9

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Patented Feb. 14, 1928. **1,659,266**

UNITED STATES PATENT OFFICE.

LEON HOMMEL, OF OAKLAND, CALIFORNIA.

MACHINE FOR MAKING METAL FASTENERS AND THE LIKE.

Application filed December 31, 1924. Serial No. 759,051.

My invention relates to a machine for making devices such as wire fasteners and the like, and in the present embodiment the machine is particularly adapted for making fasteners having a nail portion and a spacing member frictionally held on the nail portion.

An object of the invention is to provide a machine which will form a separate nail and spacing member and position the latter in frictional and slidable engagement on the shank of the former.

Another object of the invention is to provide a machine of the character described which affords a maximum output of fasteners without undue strain and wear of the machine parts.

My invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said drawings and description, as we may adopt variations of the preferred form within the scope of our invention as set forth in the claims.

Referring to said drawings:—

Figure 1 is a plan view, partly in section, of the machine of our invention.

Figure 2 is an end sectional view taken on the line 2—2 in Figure 1.

Figure 3 is a side sectional view taken on the line 3—3 in Figure 1.

Figure 4 is an enlarged side view of an intermittent gearing used in the device.

Figures 5 to 7 inclusive are enlarged fragmentary views taken substantially on the line 2—2 in Figure 1 showing the relations of certain of the fastener forming parts at different times in the fastener forming cycle.

Figure 8 is an enlarged side view of a bending cam used in my invention operatively disposed with respect to a wire end which is to be bent to desired form.

Figure 9 is a perspective view of a fastener which the present embodiment of the machine of my invention is particularly arranged to form.

A detailed description follows:

Briefly expressed, the present embodiment of my invention comprises a machine for forming a fastener having nail and spacing member portions, such as the fastener particularly illustrated in Figure 9. The materials of which the fastener is formed comprise wire of suitable size and a metal ribbon of suitable width and thickness, both materials being adapted to be continuously and automatically fed into the machine by means provided thereon. The head portion of the nail is arranged to be shaped by the operation of a cam to bend the wire end around a suitable form. During the formation of the nail head, the spacing member, which has been previously stamped from the ribbon by means of a die, is formed about the nail shank to frictionally grip the same by the successive operation of pairs of vertically and horizontally acting forming members cooperating with an anvil. The completed fastener is then arranged to be released from the machine by means which simultaneously point the nail and cut the same from the wire stock. The machine is adapted to be power driven, the parts previously referred to being suitably actuated to perform the necessary operations in proper sequence, as more particularly described hereinafter.

The nail 10 and associated spacing member 11 of the fastener which the present embodiment of my invention is particularly adapted to form are as shown in Figure 9. The nail portion 10 comprises a shank 12 having a relatively sharp pointed bend 13 formed at one end thereof and serving as a head for the nail, the bent over portion 14 forming an arcuated crotch 15 between itself and the shank. The other end of the shank 12 is preferably sharpened to provide a driving point 16. The spacing member 11 is preferably formed of a blank of metallic ribbon by bending it at an intermediate portion 17 thereof to form a recess 18 in which the shank 12 is adapted to tightly but slidably fit. As here shown, the ends 19 of the spacing member are angularly disposed and are provided with arcuate notches 21 at one side and points 22 at the other.

To form a nail and spacing member, such as described above, I provide a machine having a base 25 on which is mounted a drive motor 26 and a frame 27 which carries the nail forming means of my invention. The ribbon 28 from which the spacing members 11 are formed is arranged to be fed into the machine by means of the feeding mechanism 29 and is then passed through a longitudinal guideway 30 provided in the upper surface of a horizontally positioned fixed die-plate 31 to project therefrom. The wire 32 from which the nail portions of the fastener are formed is arranged to be fed into the machine through the feeding mechanism 33 and thence through and beyond a guide block 34 which is mounted on the frame for horizontal reciprocative movement transversely of the wire. At the beginning of a fastener forming cycle the projecting portion of the wire is disposed transversely of the projecting portion of the ribbon in a line parallel to and closely underlying the plane of the ribbon and extends beyond the ribbon. Immediately beneath the portion of the extended wire adjacent the guide block 34 is an anvil 35 in the form of an inverted V fixedly positioned on the frame 27 and having an upper edge extending parallel to, and adapted to serve as a seat for the wire.

The notches 21 and points 22 of the spacing member 11 are arranged to be formed in the ribbon by means of male cutting dies 37 mounted on opposite sides of a vertically moving plunger 38 and cooperating with female dies 39 mounted on the die-plate 31, the pieces removed falling through the die-plate apertures into the space defined by the base 25. Also mounted on the plunger 38 for movement therewith is a shearing blade 41 which also serves as one member of a two-point bending die 42, the former being adapted to cooperate with the forward edge 43 of the die plate 31 to sever the spacing member blank from the ribbon, and the latter functioning, after pressing the severed blank and underlying wire upon the anvil 35, to bend the blank about its center to straddle the anvil. Since the wire was pressed slightly downward to contact with the anvil, the raising of the plunger 38 after completion of the bend forming stroke allows the wire to spring slightly upward, raising the blank with it to a position slightly clear of the anvil, as shown in detail in Figure 7. With the bent blank in raised position, oppositely disposed forming members 45 and 46 are advanced horizontally to simultaneously cooperate in the formation of the recess 18 of the spacing member 11 by acting in a plane slightly below that of the axis of the wire to press the sides of the blank together to firmly embrace the wire, the members 45 and 46 being here shown extending from oppositely positioned reciprocable blocks 47 and 48 mounted on the frame. It will be noted that the side faces of the anvil 35 cooperate with the lower faces 49 of the members 45 and 46 to determine the desired angular relation of the ends 19 of the now completed member 11, as shown in Figure 7. The bending die 42 is preferably provided with a spring pressed plunger 50 which is adapted to maintain a resilient pressure on the blank during the forming of the spacing member 11 thereof and thereby hold it properly positioned across the wire.

While the member 11 is thus being formed, a movable anvil 51 mounted for horizontal movement in the frame of the machine and having an end section similar to the desired shape of the nail crotch is moved to a position beneath the inner part of the protruding wire end so that a portion thereof will overhang the anvil. A cam 52 suitably mounted for rotation about a horizontal axis and in a plane including the wire, is then actuated to first bend the wire end which overhangs the anvil downwardly over the edge 53 of the anvil and then bend the end inwardly to lie against the face 54 of the anvil, which is here shown angularly disposed from the vertical plane, it being now noted that the crotch 15 and head 13 of the nail portion 12 of the fastener have thus been simultaneously formed. As particularly shown, in Figure 8, the cam 52 is mounted on a pivot 56 and is provided with a point 57 which is so positioned with respect to the anvil that when brought downwardly from above on a wire end extending therefrom, the wire end will be bent downwardly around the edge 53 of the anvil, the cam being formed with a transverse recess 58 extending inwardly of and below the point 57 and arranged to receive the wire end prior to the bending operation. The lower surface 59 of the recess 58 is preferably formed to conform with the shape of the face 54 of the anvil, so that when brought against the wire end which has been bent downwardly over the anvil, it will bend the same inwardly against the anvil to complete the crotch 15. It will now be noted that in order to perform the before mentioned functions, the cam 52 must be reciprocatively rotated through a small arc during part of a fastener forming cycle, and, accordingly, in the present embodiment of the invention, the cam 52 is provided with an integral lever arm 61 by which such motion may be imparted to the cam in a suitable manner. By referring to Figure 8, it will be noted that the cam 52 is shown therein in full lines in wire receiving position, in dotted lines as positioned at the conclusion of the downward bending operation, and in dash lines as positioned at the conclusion of the inward bending operation.

Mounted on reciprocable blocks 62 and 63 and positioned between the forming members 43 and 44 and the end surface 64 of the guide-block 34, are cooperating cutters 65 and 66 which are arranged to be brought transversely together to cut the wire to form a notch therein, said notch having a transverse side parallel to the surface 64 and a bevelled side sloping away from such transverse side. The relation of the cutters 55 and 56 before and during the cutting operation is shown in detail in Figures 5 and 6.

With the nail and spacing members thus formed and assembled in proper relation, and the wire notched and firmly held between the cutters at the point of the nail, a transverse horizontal movement of the block 34 is arranged to be effected so as to sever the fastener from the remaining wire. The anvil 49 is arranged to be then withdrawn and the members 45 and 46 separated, so that the fastener may fall clear of the forming mechanism and the machine be enabled to start the next cycle of operations.

Driving of the machine is here shown arranged to be effected from a main drive-shaft 71 which is positioned transversely of the frame adjacent one end thereof and is operatively connected to the motor 26 through a clutch 72, a shaft 73, and suitable gearing arranged in the housing 74. The shaft 71 is mounted in the bearings provided in the housing 74, and in a bearing 74′. Operatively connected to the opposite ends of the shaft 71 by means of pairs of bevel gears 75 and 76 are secondary shafts 77 and 78 respectively, mounted in sets of bearings 79. In the present embodiment, the shafts 71, 77 and 78 are arranged to rotate at the same rate, one revolution thereof serving to complete one fastener making cycle.

Feeding of the ribbon 28 through the feeding mechanism 29 is here shown arranged to be effected by driving an upper roll 81 thereof carried on a shaft 82 by means of a suitable intermittently acting mechanism operatively connected between the shafts 77 and 82. The driven roll 81 is preferably corrugated and is adapted to firmly hold the ribbon against a cooperating roll 84 so that the ribbon may be advanced when the driven roll is turned.

The wire 32 is arranged to be fed through the feeding mechanism 33 by means of a lower roll 85 of the latter, which is mounted on a shaft 85′ and is arranged to be rotated by means of a suitable intermittently acting mechanism operatively connected to the shaft 77 by a shaft 86 and bevel gearing 87. An upper roll 89 which is adapted to cooperate with the roll 85, is provided having a circumferential groove 88 in which the wire is adapted to be positioned, the surface of said groove being preferably transversely corrugated so as to form corresponding impressions on the wire. The circumferential surface of the roll 84 is also corrugated, but has no groove formed therein. Pressure between the rolls sufficient to flatten opposite sides of and form the corrugations in the wire as it passes therebetween, is arranged to be adjustably secured by mounting the upper roll 89 on one end of a lever 91 pivotally secured at its other end to the frame, the lever being arranged to be actuated by turning the nut on a bolt 92 secured to the frame and extending through an aperture midway of the lever 91. Adjustment between the rolls is thus made possible either for different depths of corrugation or different sizes of wire. It is to be noted that by corrugating the wire, a nail shank is provided which will not readily turn in the spacing member 11 or in the material into which it may be driven.

As here shown, the mechanisms by which the feeding rolls 81 and 84 are arranged to be intermittently driven comprise a type of intermittent gear movement, the gearing used for converting the uniform rotation of the shaft 86 into an intermittent rotation of the shaft 85′, which is parallel thereto and carries the roller 85, being shown in detail in Figure 4. Fixed to the shaft 85′ is a driven member 93 provided with symmetrically disposed radially extending slots 94 of uniform width while a planetary roller 95, suitably mounted on a member 96 for rotation with and around the shaft 86 in coplanar relation with the member 93 is arranged to engage successive slots 94 and thereby serve as a driving means for the member 93. The shafts 85′ and 86 are so spaced apart that when the axis of one slot 94 is tangent to the arc of movement of the roller 94, the axis of an adjacent slot will also be tangent to the same arc of movement of the roller but on the opposite side of the line of centers of the shafts. In this manner, with a slot in tangential relation to the arc of movement of the roller, the rotation of the shaft 86 will cause the roller to enter the slot and bear against the forward side 97 thereof to cause the rotation of the member 93 until such a time as it again assumes a position tangent to the arc of movement of the roller, at which time the roller will leave the slot. It will now be noted that the rotative movement thus imparted to the member 93 and its shaft 85′ will be one wherein the rate of rotative movement produced will accelerate gradually to a maximum and then as gradually decrease, thus avoiding any sudden movements or impacts of the feeding mechanism which would result in increased wear and a noisy operation of the parts. To insure the proper positioning of the member 93 at all times relative to the roller 95, a circular disc 98 is provided which is coaxially mounted on the member 96 in coplanar relation with the member 93, and each portion of the periphery of the member 93 is provided between the slot portions with concave surfaces 99 having substantially the same radius of curvature as the edge surface 101 of the disc and arranged to slidably engage the latter during the time that rotation of the member 93 is not being effected by the roller. Since rotation of the member 93 would cause a portion of a surface 99 to bear against the disc surface 101; it will be evident that rotation of the member 93 will thus be prevented. To allow rotation of the member 93 by the roller, a recess 102 is provided in proper position in the disc edge, such recess being here shown by arcuate form, the center of curvature thereof being colinear with the axes of rotation of the roller 95 and shaft 86 and the radius thereof very slightly exceeding the extreme radius of the member 93. In this manner, it will now be noted that an intermittent gear structure has been provided which is at all times positive in its action and one which, at the same time is smooth and quiet in operation.

The plunger 38, which carries the cutting dies 37, shear blade 41, and bending die 42, is arranged for reciprocation in a guideway 111 provided on an upper portion 112 of the frame by means of operative connection to the drive shaft 71. Mounted on the shaft 71 is an eccentric disc 113, about which an eccentric strap 114 carried on a connecting rod 116 is mounted. The rod 116 is connected at its other end to a crank pin 117, the latter being carried by a crank arm 118 provided at the end of a crank shaft 119, it being noted that the shaft 119 is suitably journaled in a pair of bearings 121 and 122 with its axis horizontal. A second crank 123 is provided on the shaft 119, preferably between the bearings thereof, and is operatively connected to the plunger 38 by means of a connecting rod 124 of adjustable length, the rod being here shown pivotally connected to the crank 123 in a usual manner and to the plunger 38 by means of a universal ball and socket joint 126, the ball portion of the latter being here shown carried on the connecting rod 124. The arc of motion of the crank pin 117 is preferably arranged to have a greater radius than is the radius of the arc of eccentricity of the eccentric disc 84, so that the crank pin will be oscillated through an arc of slightly less than 90 degrees as the connecting rod 86 is reciprocated. This arrangement for oscillating the crank shaft 119 is particularly designed to prevent difficulties with dead centers which might occur if the pin 117 were allowed to travel through a complete arc.

Simultaneous cooperative movement of the blocks 47 and 48 which carry the forming members 45 and 46 respectively is here shown arranged to be effected by means of heart or disc cams 131 and 132 mounted respectively on the shafts 77 and 78. Each of the cams 131 and 132 is provided with a roller groove 133 formed in a side face thereof in which a roller 134 carried on a fork 136 which spans the shaft and is carried on a connecting rod 137, is arranged to engage. The other ends of the rods 137 are adjustably attached to the blocks 47 and 48. In this manner, reciprocative movements of the blocks are produced in accordance with the shape of the roller groove, it being obvious that the roller grooves 133 of the cams 131 and 132 are necessarily complementary in form and action.

The movable anvil 51, which is utilized in forming the crotch of the nail, is here shown operated from the shaft 78 by means of a roller 141 carried on a fork 142 and engaging in a roller groove 143 formed in the opposite side of the cam disc 132 from the fork 136 associated therewith. An adjustable rod 144 connects the fork 142 to a block 146 which carries the anvil 51, the block being slidably mounted in a suitable guideway 147 provided in the frame.

The bending cam 52 is arranged to be oscillated upon rotation of the shaft 71 by means of a cam operated connecting rod 148 pivotally secured at one end to the lever arm 61 of the cam and carrying a fork 149 at the other end. Mounted on the fork is a cam roller 151 which is arranged to engage in a groove 152 provided in one face of a cam disc 153 mounted on the shaft 71, the rotation of the disc being thus arranged to impart the desired reciprocative movement to the rod 148 and thus to the bending cam 52.

Simultaneous cooperative movement of the blocks 62 and 63 which carry the cutters 65 and 66 is here shown arranged to be accomplished by means of connecting rods 155 and 156 respectively which are arranged to be reciprocated by means of eccentrics 157 and 158 operatively associated therewith and respectively carried on the shaft 77 and 78. As here shown, the eccentric 157 is out of alignment with the blocks 62 and 63 and the eccentric 158, and the motion of the rod 155 is accordingly communicated to the block 62 by means of a rocker arm 159 of such width that attachment of the rod and block to opposite sides thereof will serve to position the rod and block in required parallel relation.

The guide block 34, which, as hereinbefore mentioned, is moved to finally sever the completed fastener from the wire, is secured to a slidable member 161 reciprocatively mounted on the base and operatively connected to the shaft 78 by means of a rod 162 terminating in a roller carrying fork 163, the roller 164 thereof cooperating with a groove 165 formed in a heart-cam disc 166 mounted on the shaft to thereby produce the desired motion of the block 34.

By referring to the drawings, it will be seen that the blocks 47 and 62 are held positioned in their guideways by means of a removable plate 167. The blocks 46, 48, 63 and 34, all of which are actuated from the shaft 78 and are mounted in adjacent and parallel bearing grooves formed in the frame, are held in position by means of the removable plate 168. Removable plates 169 also serve to hold the plunger 38 in the guideway 82.

It will be evident from the foregoing that the order and extent of the movements of the fastener forming cycle in relation to the movement of the plunger 38 is entirely controlled by means of the form and relative positioning of the roller grooves in the various cam plates and the eccentricities of the eccentrics employed, the succession of desired operations being thus readily controllable, and since any or all of the dies, cutters and various fastener forming tools may be adjusted or replaced, the proper performance of the various forming operations may be readily maintained. Furthermore, it will be obvious that on account of the removability and independent operation of the various forming mechanisms, the machine is readily adaptable for forming other articles of manufacture than the fastener herein specifically described.

I claim:—

1. A machine for forming spacing members about the shank of a nail, comprising means for forming and positioning a blank for said member, a fixed anvil in the shape of an inverted V on which said nail shank is adapted to be seated and across which said blank is adapted to be positioned, a vertically acting means for bending said blank to the shape of said anvil, and independent cooperating means for bending a portion of said blank to encircle said shank.

2. A machine for making a fastener having a nail element and a spacing element formed about the shank thereof comprising feeding devices for intermittently and simultaneously positioning the requisite amount of material for forming said spacing element about the shank of said nail element, means for stamping and severing a spacing element blank, a fixed anvil on which said spacing element is adapted to be shaped, means for shaping said spacing element on said anvil and about said shank, a movable anvil about which an end of said nail element is adapted to be bent to form a head therefor, a cam operable to completely shape said head about said movable anvil, and means operable for severing and releasing said fastener when completed.

3. A machine for making a fastener having nail and spacing portions, comprising feeding mechanisms adapted to supply and position requisite amounts of materials of which to form said portions, a cutting die adapted to sever a blank for said spacing portion, a fixed anvil in the form of an inverted V on the apex of which the shank of said nail portion is adapted to be longitudinally positioned, a downwardly acting die adapted to bend said blank over said shank and anvil, plungers movable horizontally and adapted to complete the bending of said blank to encircle said shank, means for simultaneously forming a head on said nail portion, and means operated independently of said plungers for sharpening and severing a completed fastener.

4. A machine for making in assembled form a fastener having nail and spacing portions, comprising a mechanism adapted to simultaneously feed and position at right angles in substantially the same horizontal plane the requisite amounts of materials of which to form said portions; a fixed anvil in the form of an inverted V having the apex thereof arranged to receive the shank of said nail portion; a movable anvil about which a head for said nail is adapted to be formed by bending an end of the nail portion material; a cam arranged to completely form said head about said movable anvil; a downwardly acting member having members independently mounted thereon arranged to substantially simultaneously form a blank for a spacing portion, sever the protruding blank, and bend the severed blank over said shank; cooperating members movable horizontally and adapted to complete the bending of said blank to encircle said nail shank; independent means adjacent said plungers for simultaneously sharpening and gripping a completed fastener; means for transversely moving said wire adjacent said gripped point to shear said fastener therefrom; and means operative to cause the operations of said various fastener forming means in proper sequence.

5. A machine for making in assembled form a fastener having nail and spacing portions formed of wire and metallic ribbon respectively, comprising a frame; shafts mounted on said frame and operatively connected for simultaneous rotation; an intermittently acting wire feeding mechanism operatively associated with one of said shafts; a movable guide block through which said wire is adapted to be fed; an intermittently acting mechanism for feeding the ribbon transversely of and slightly above the wire and operatively associated with one of said shafts; a fixed die plate over which said ribbon is adapted to pass; an anvil in the form of an inverted V and arranged at the top edge thereof to receive the wire; cooperating mechanisms including a movable anvil and a cam for completely forming a head on said nail portion by bending, each of said mechanisms being operatively connected to one of said shafts by means including a heart cam; a vertically movable head having removably mounted thereon a die adapted to cooperate with said die plate to perforate the ribbon lying thereover, a cutter blade adapted to cooperate with the extremity of said die plate to sheer from the ribbon a spacing member blank, and a bending die adapted to bend said blank over

said wire, said movable head being arranged to be reciprocated by means including an eccentric operatively connected to one of said shafts; cooperating members adjacent the guide block for completing the formation of said spacing member portion about the shank of said nail portion, said members being mounted in reciprocable blocks arranged to be reciprocated by means including independent eccentrics mounted on said shafts; cooperating members for notching and gripping the portion of the wire adapted to form the point of the nail portion of the fastener, said members being mounted on independently reciprocable blocks arranged to be reciprocated by means including heart cams mounted on said shafts; and means including a heart cam for transversely moving said guide block when the wire is held by said gripping means to shear said fastener from the wire adjacent the gripped point.

6. A machine for forming spacing members about the shank of a nail, comprising means for forming and positioning a blank for said member, an anvil on which said nail shank is adapted to be seated and across which said blank is adapted to be positioned, and means cooperating with said anvil to bend said blank to encircle said shank.

In testimony whereof, I have hereunto set my hand at Oakland, California, this 26th day of December, 1924.

LEON HOMMEL.

DEFENDANT'S EXHIBIT "J"

E. H. Binns et al. Patent No. 2,026,413

Filed Nov. 21, 1930 Patented Dec. 31, 1935

METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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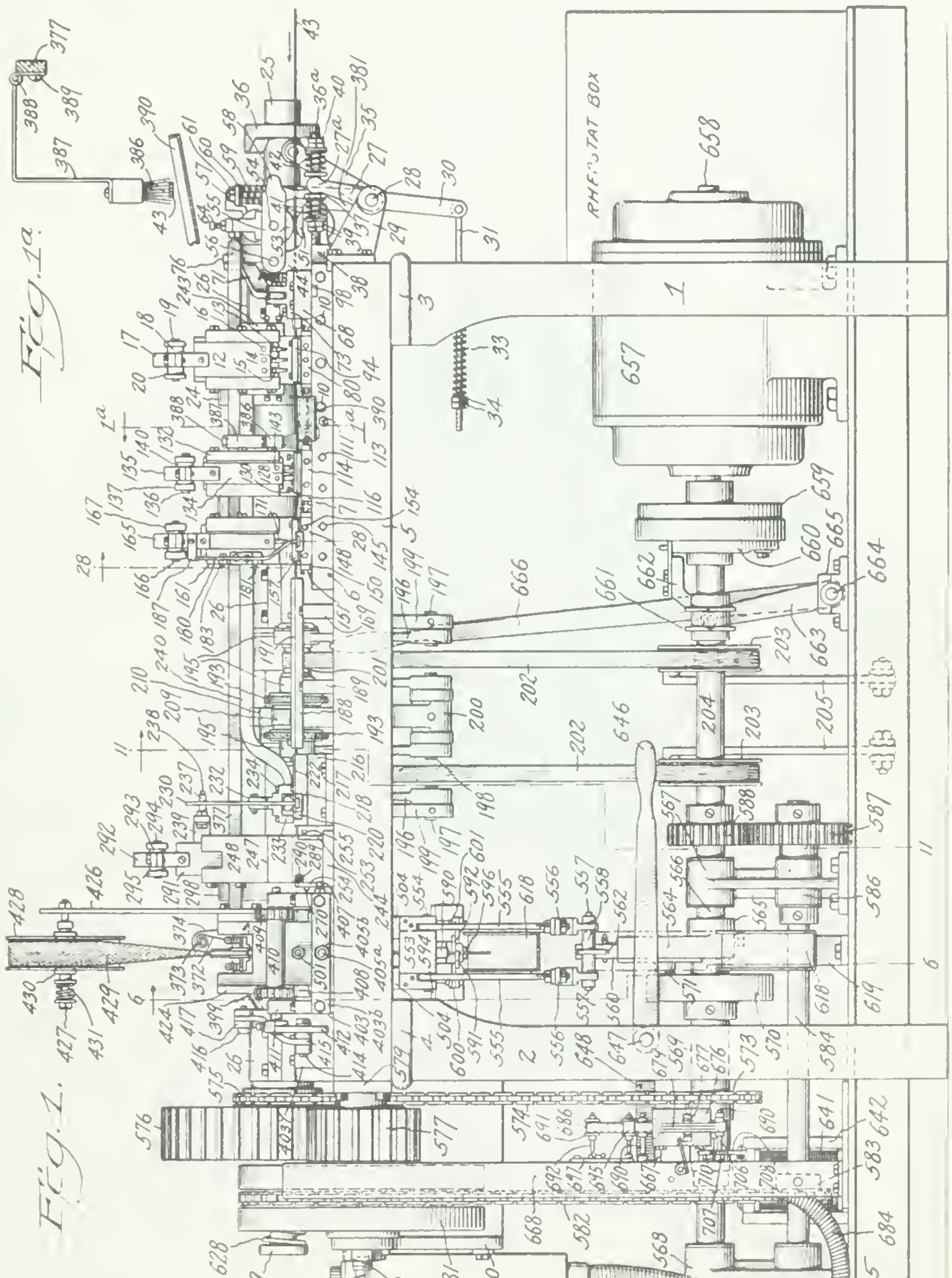

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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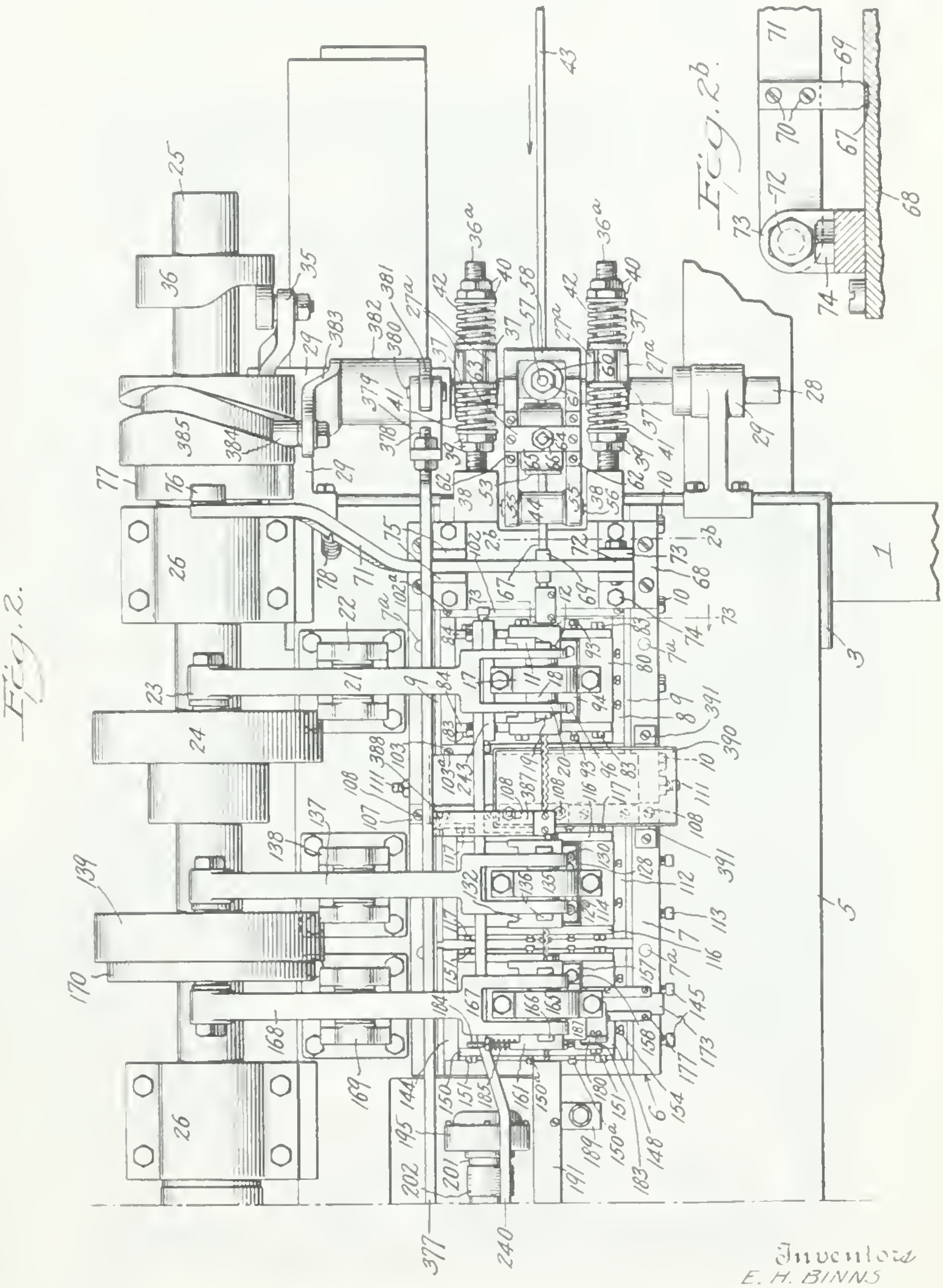

Fig. 2.

Fig. 2b.

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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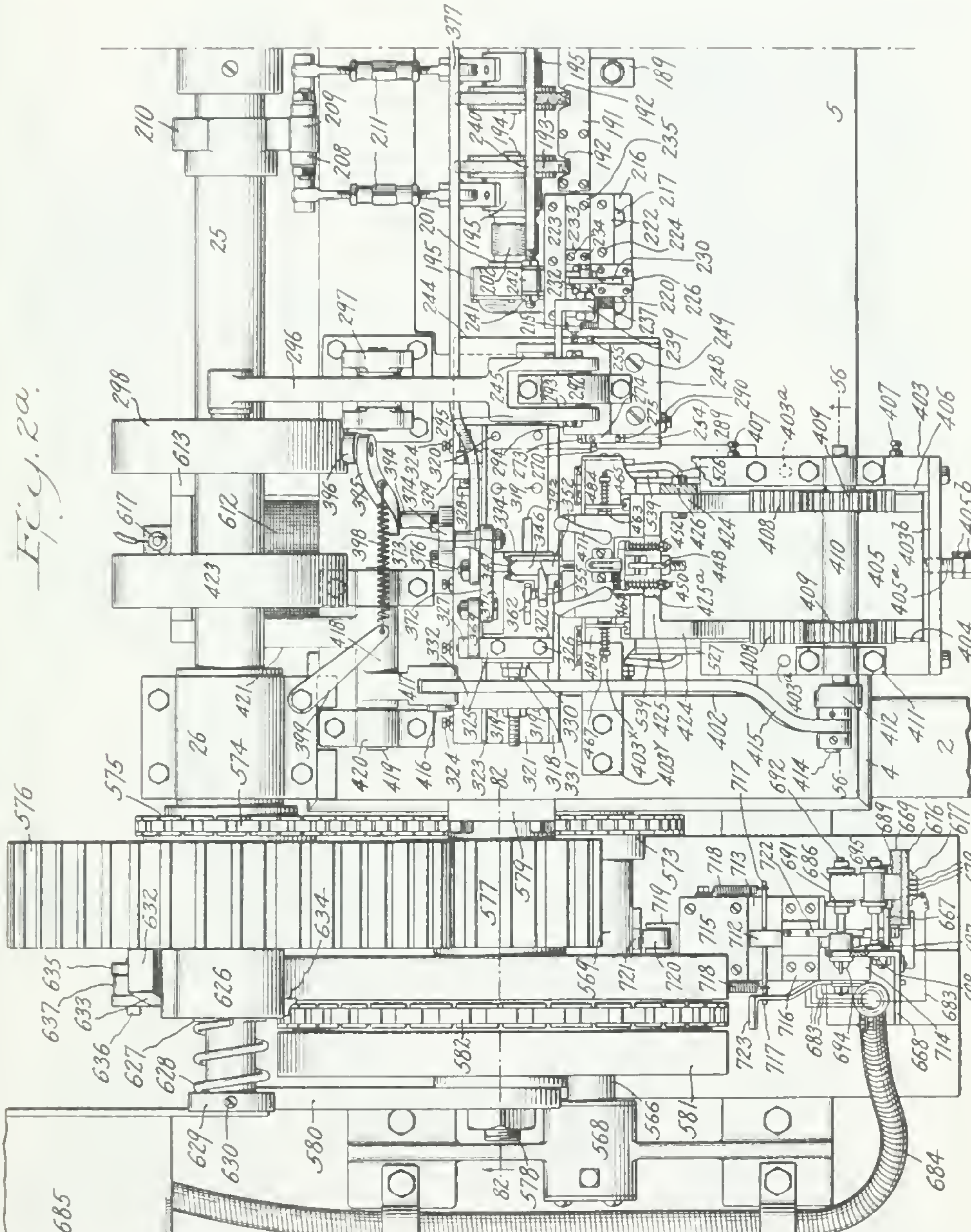
Fig. 2a.



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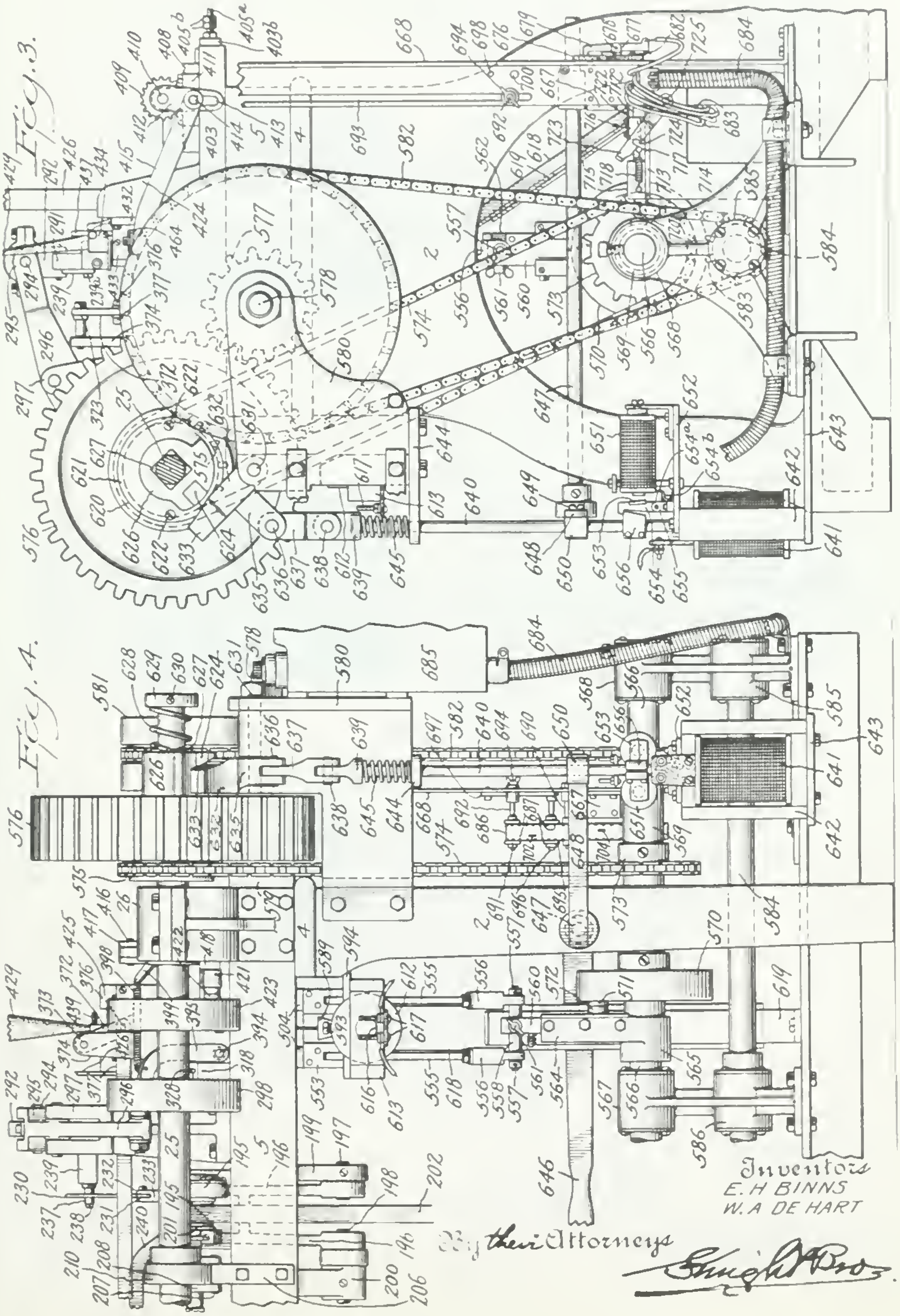
METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

Filed Nov. 21, 1930 27 Sheets-Sheet 4



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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 57.

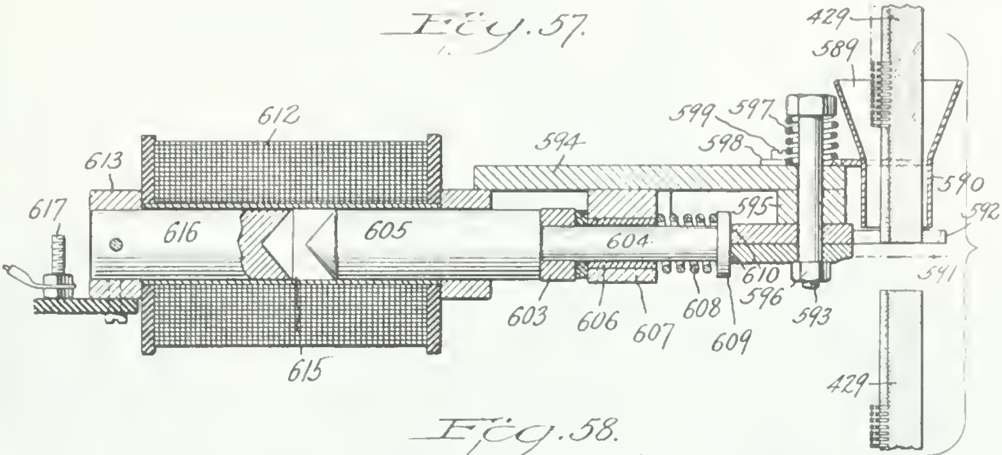


Fig. 58.

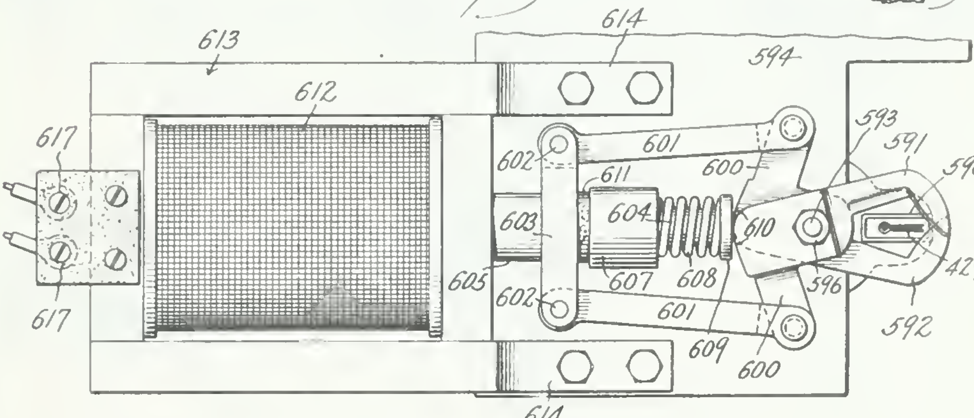
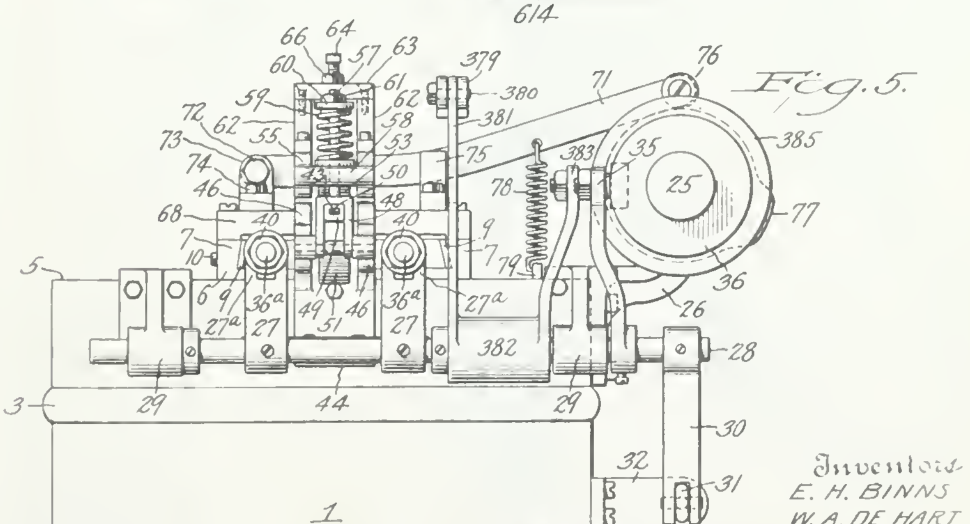


Fig. 5.



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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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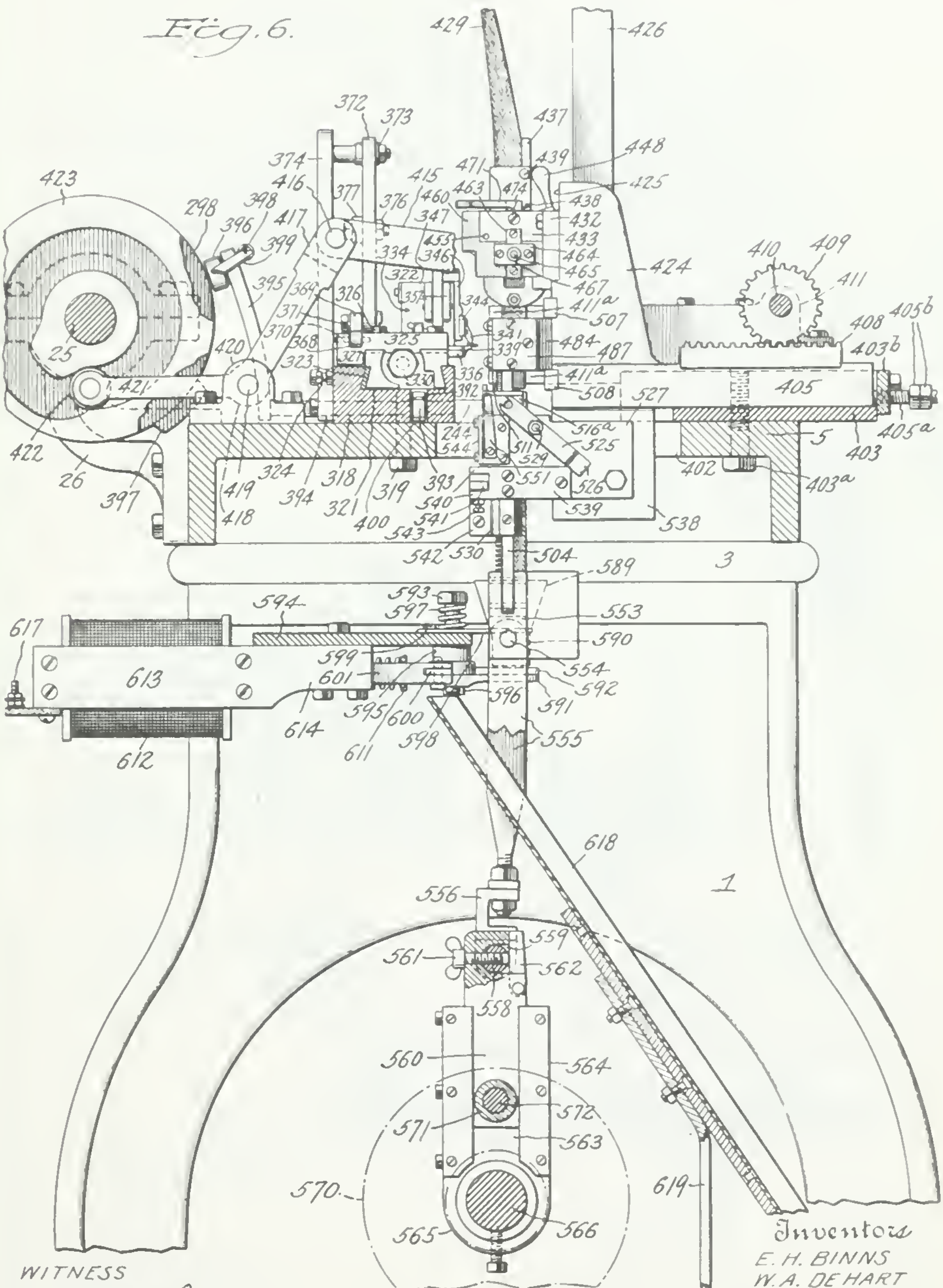
Fig. 6.



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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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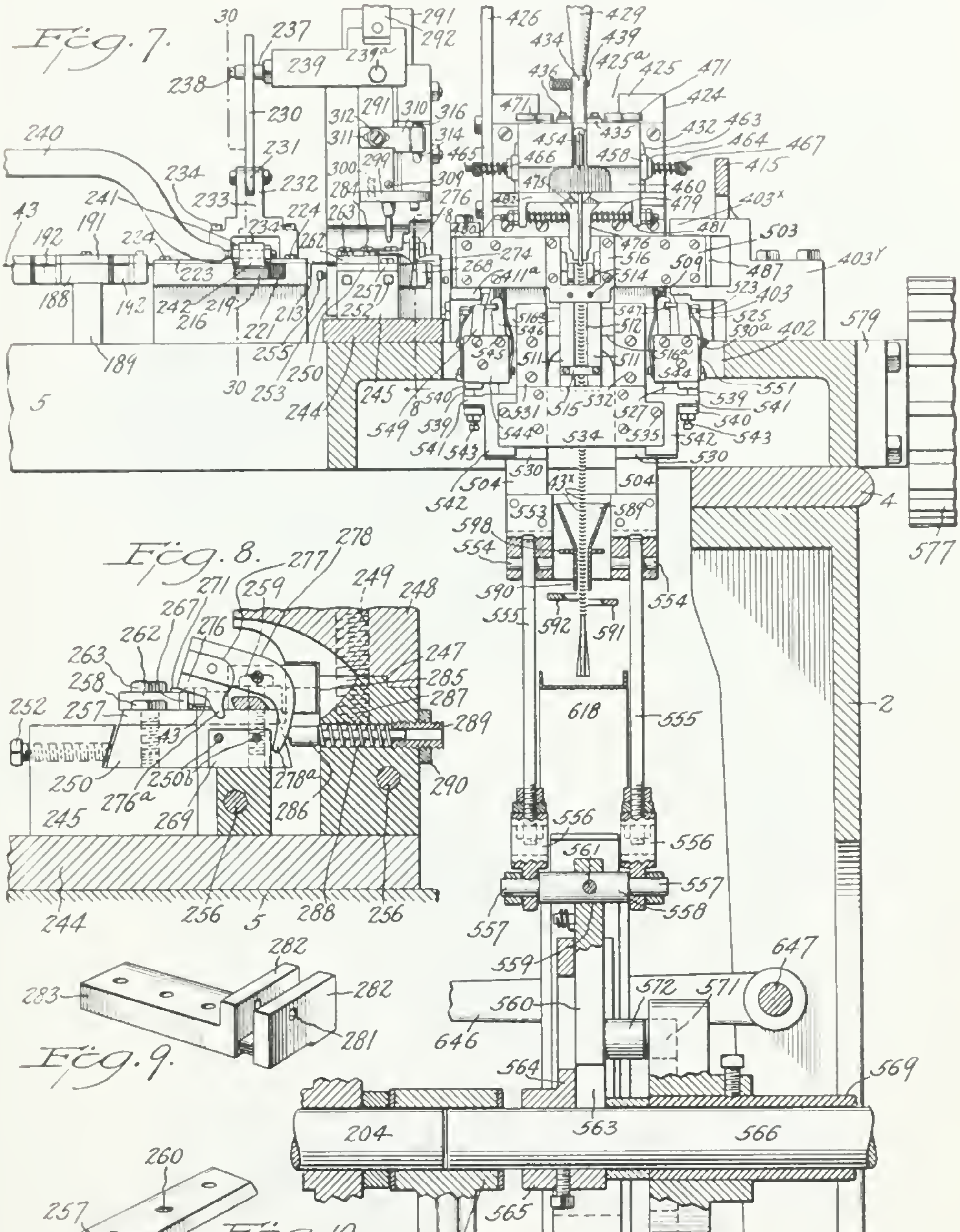

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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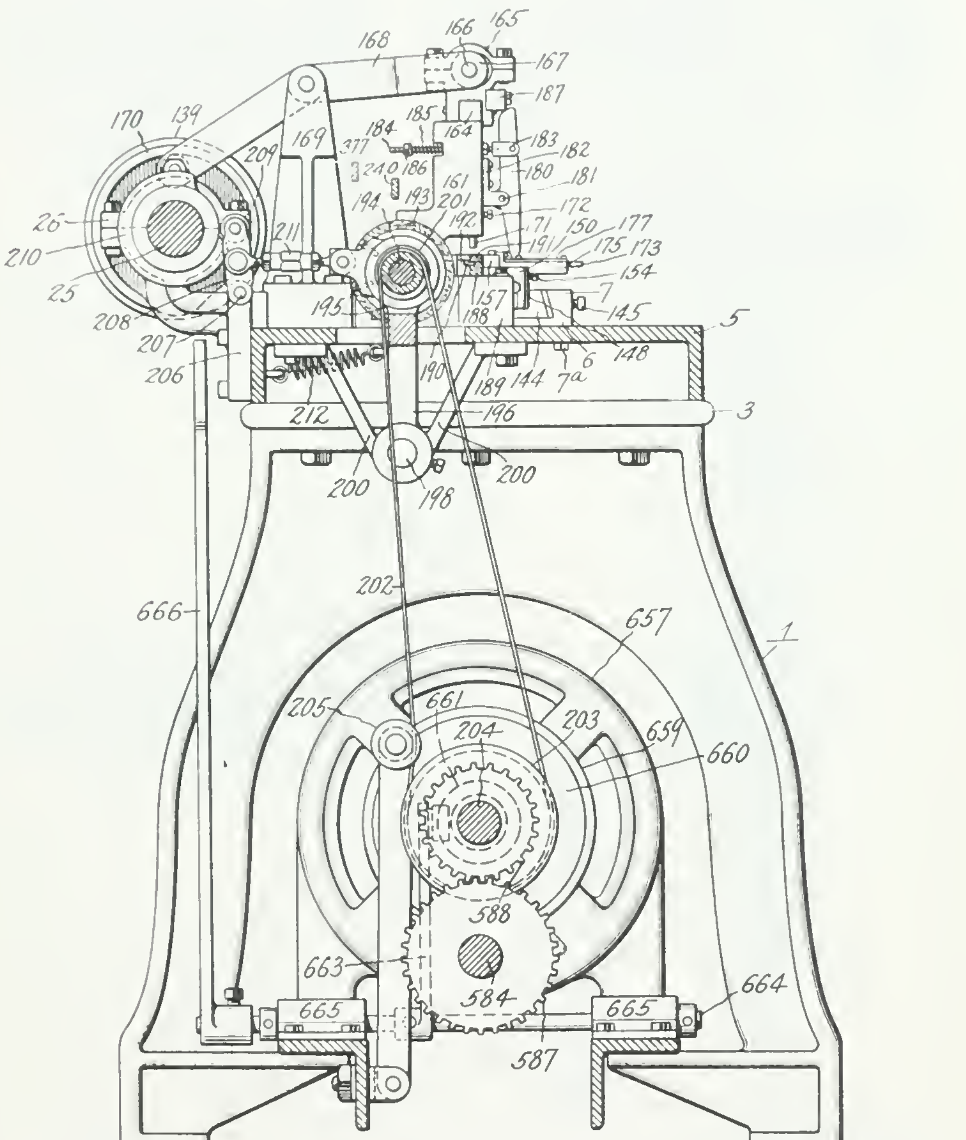
Fig. 11.



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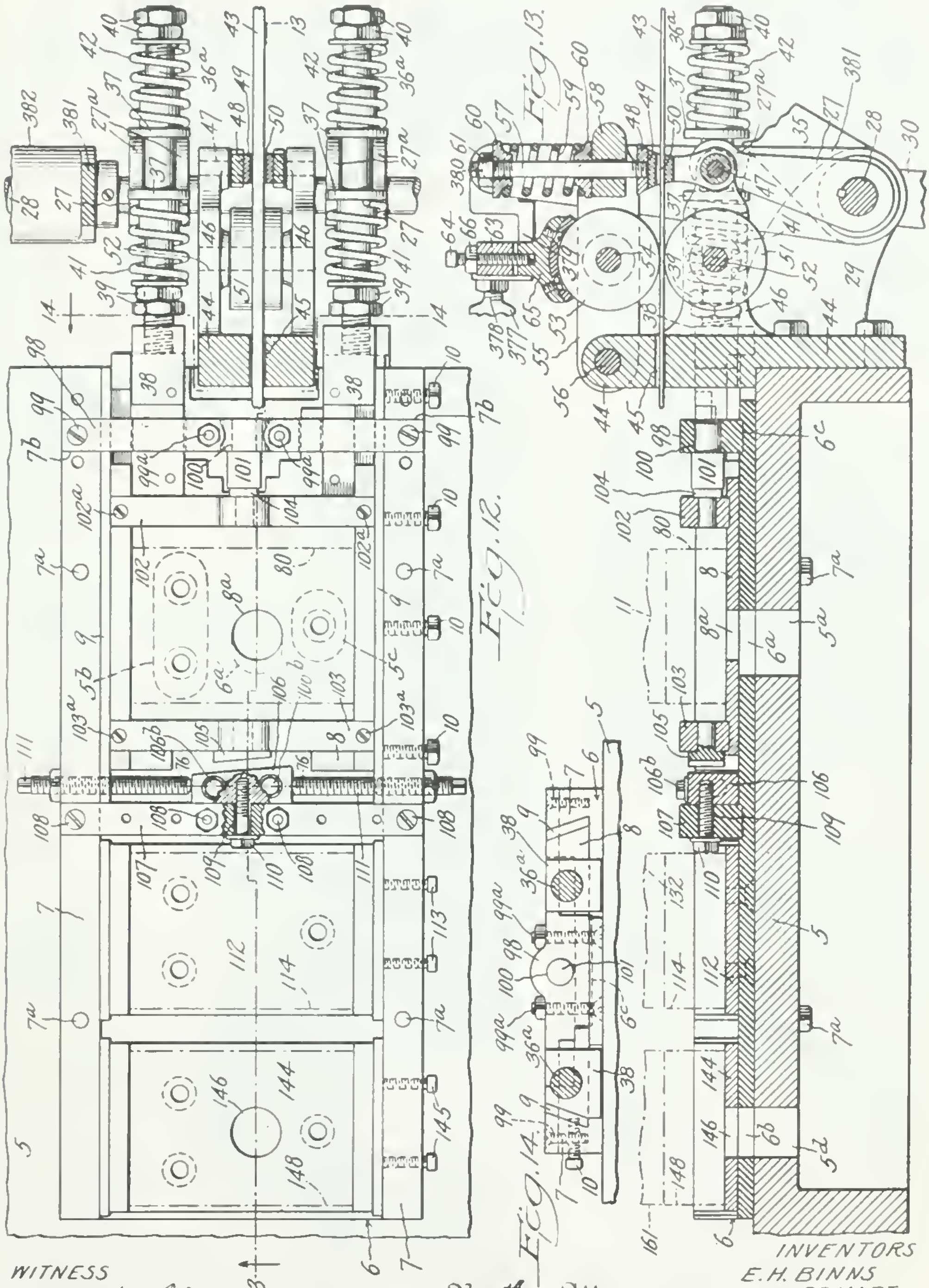
METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

Filed Nov. 21, 1930 27 Sheets-Sheet 9



WITNESS
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Dec. 31, 1935. E. H BINNS ET AL 2,026,413

METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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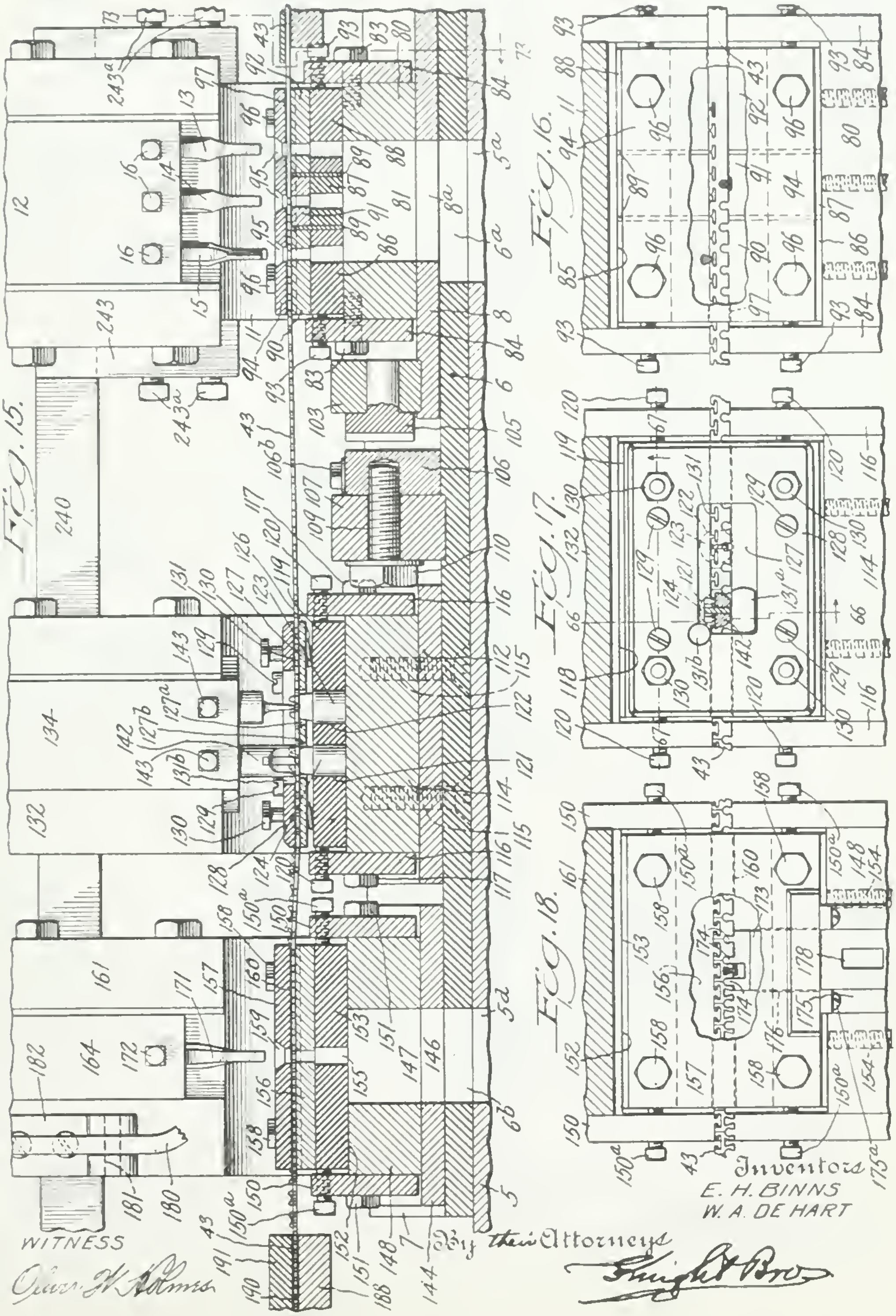

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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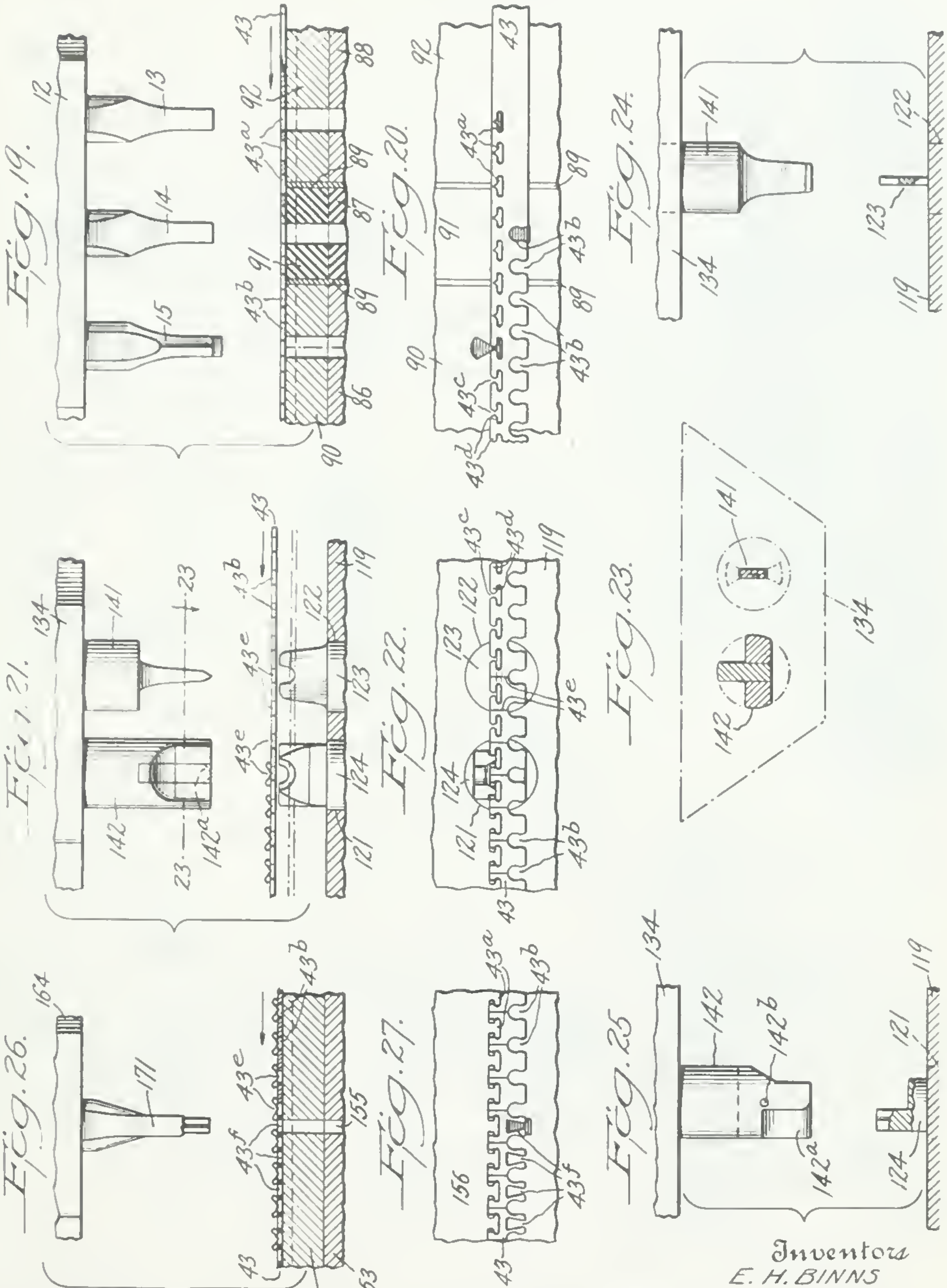

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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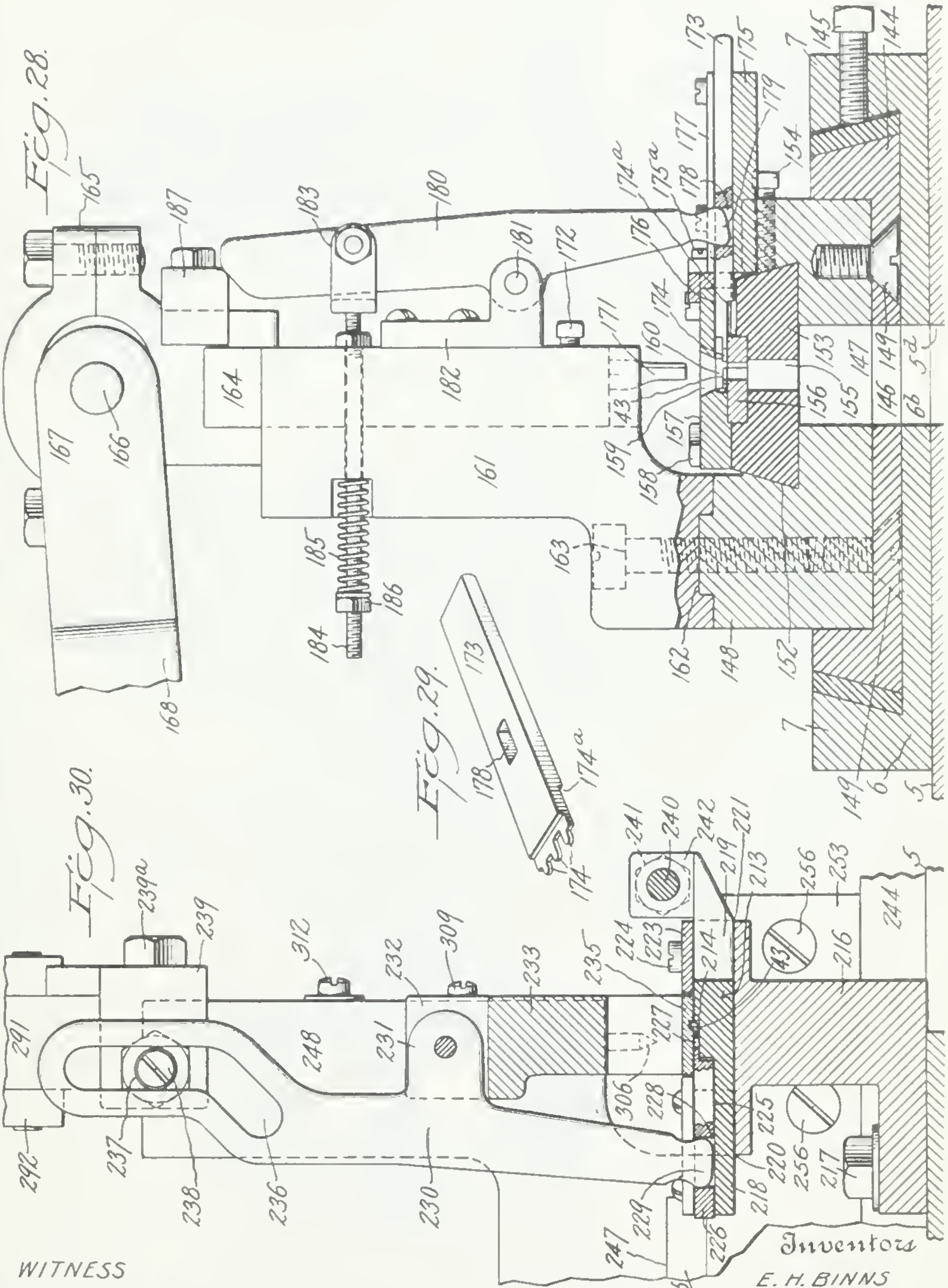

Fig. 28.

Fig. 29.

Fig. 30.

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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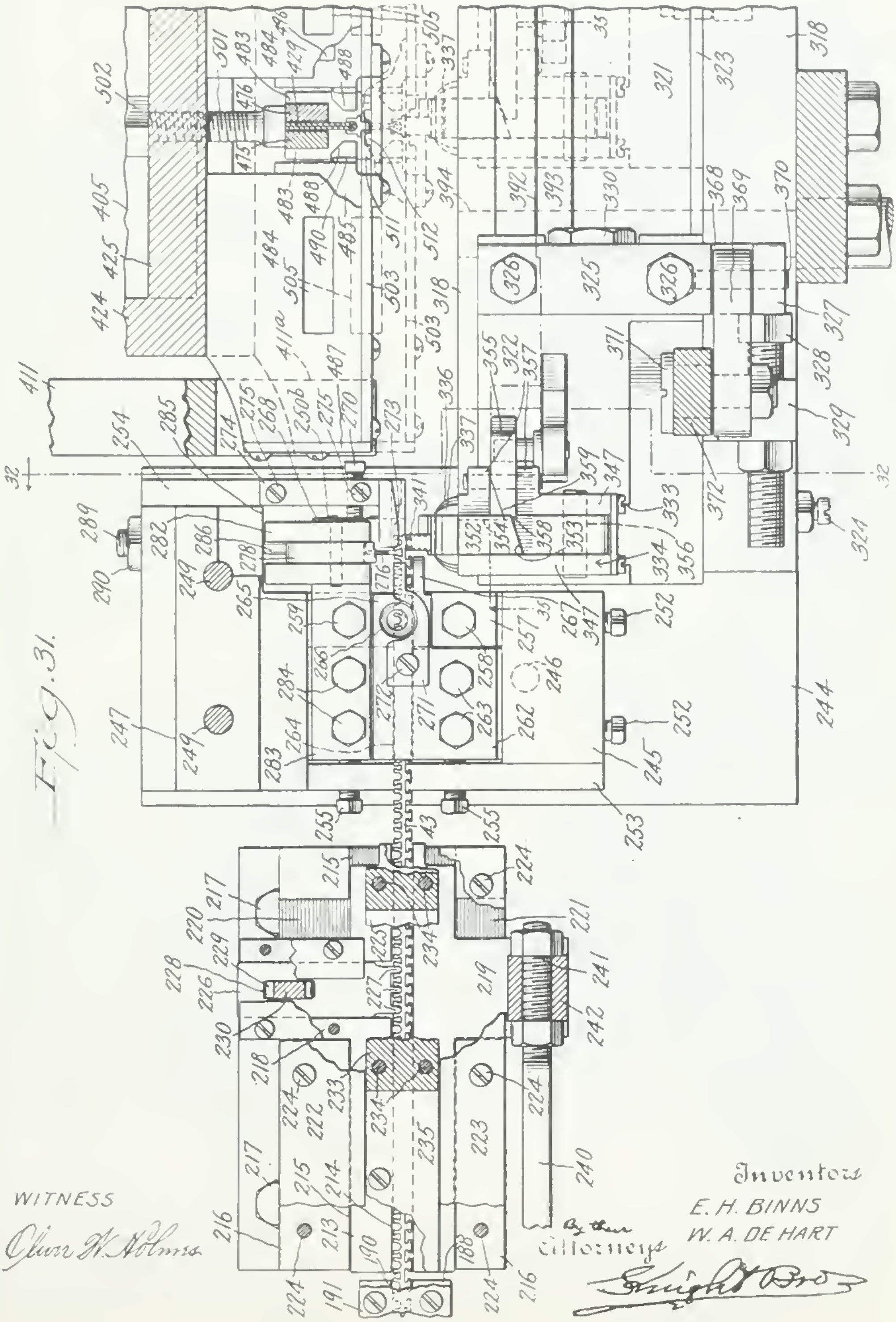

Fig. 31.

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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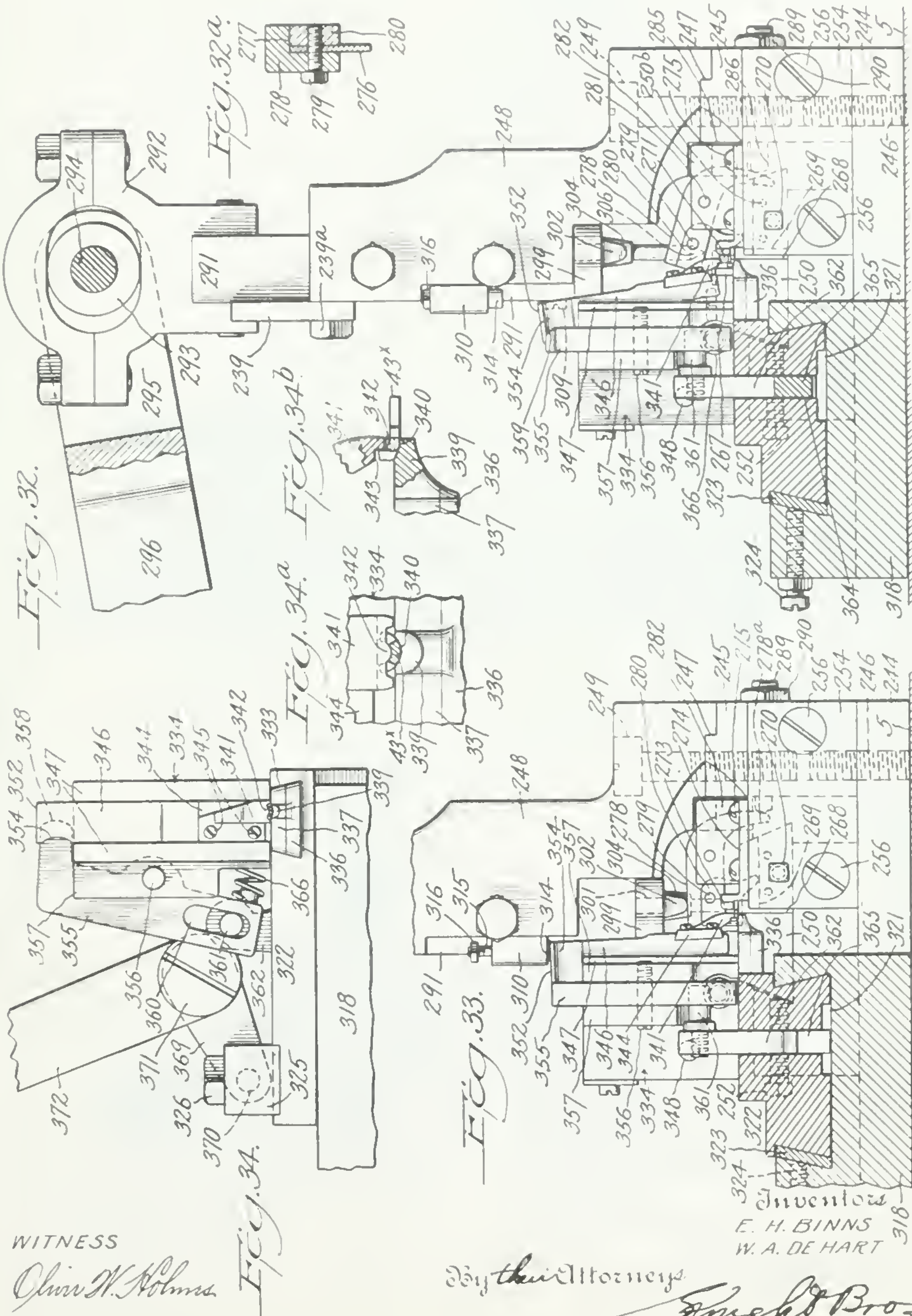

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 35.

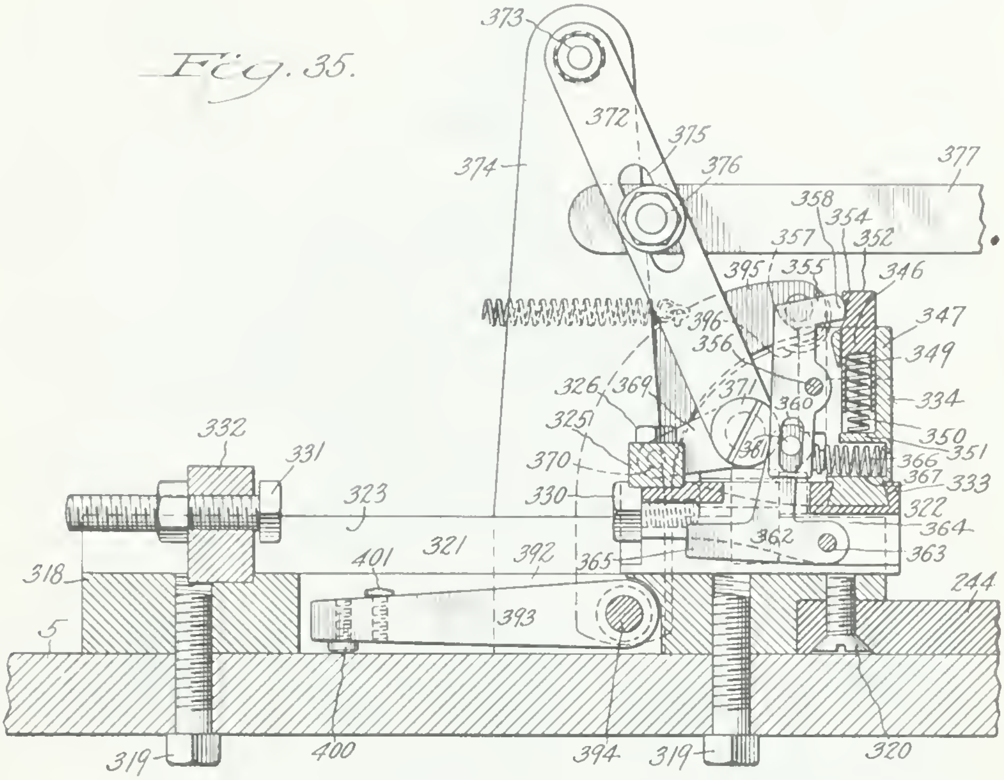
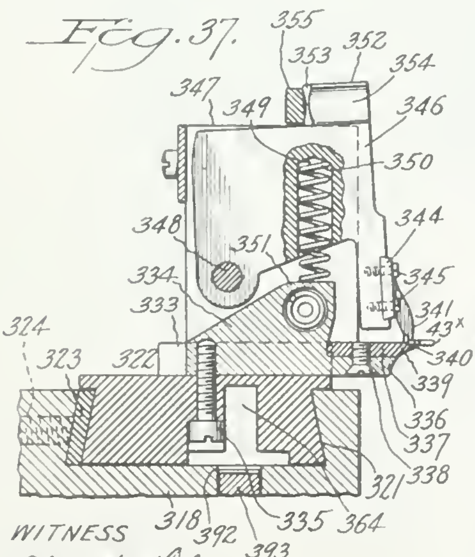


Fig. 37.



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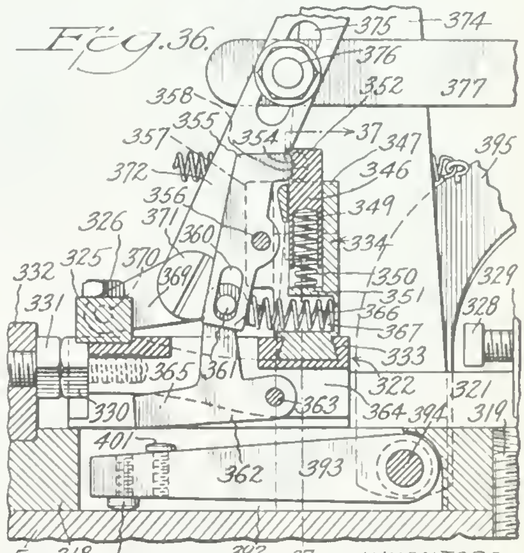

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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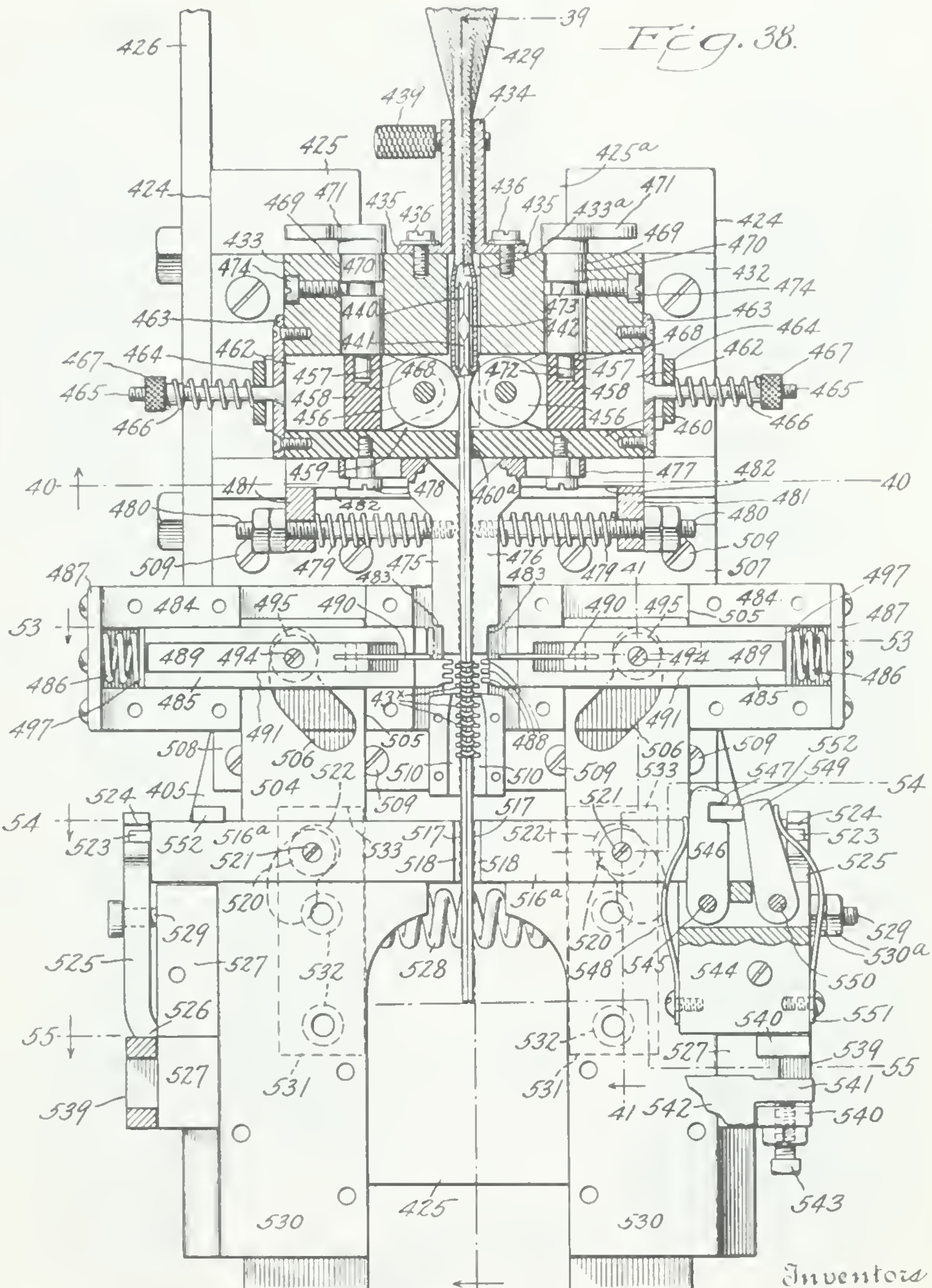
Fig. 38.



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Dec. 31, 1935. E. H. BINNS ET AL 2,026,413

METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 39.

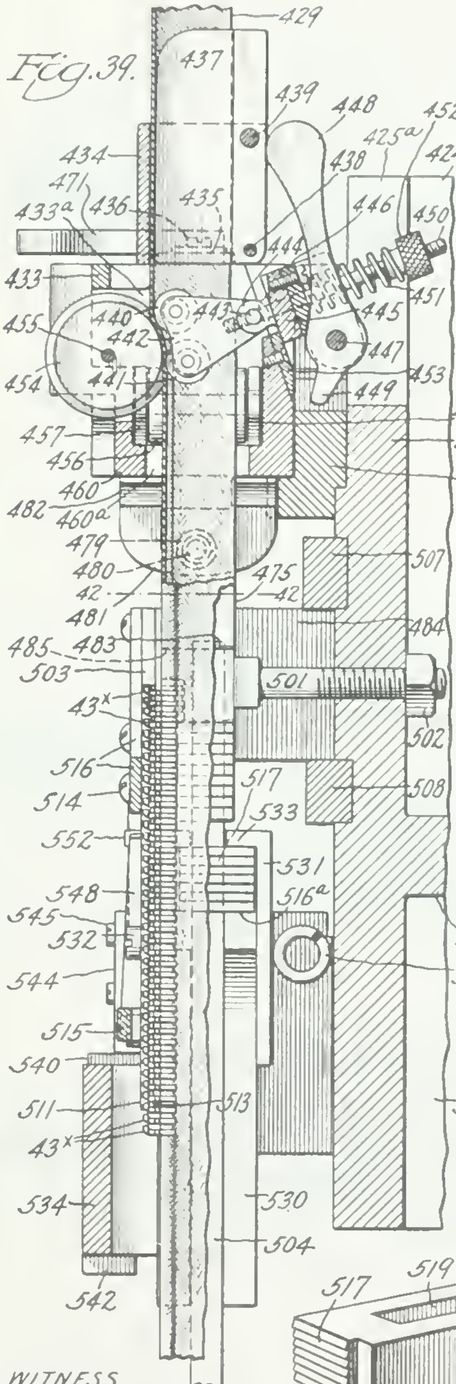
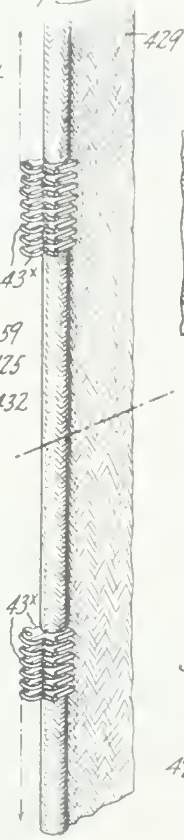


Fig. 39b.



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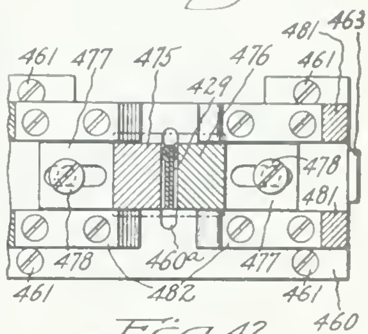

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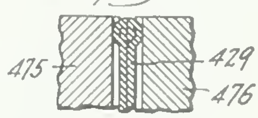

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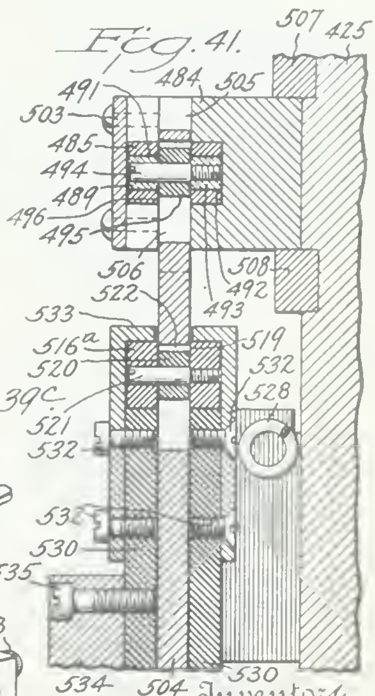
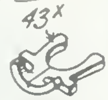


Fig. 39c.



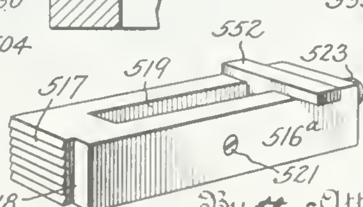


Fig. 39a.

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Fig. 43.

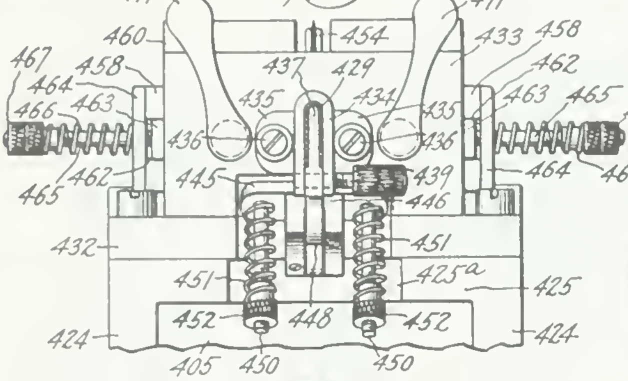
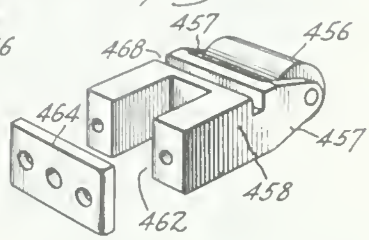


Fig. 46.



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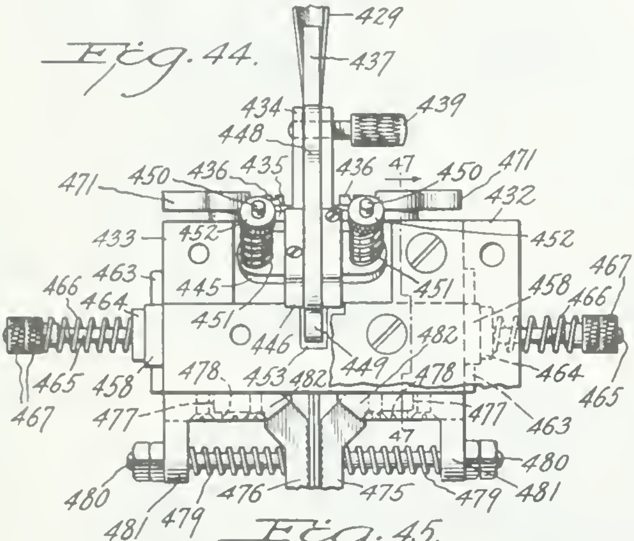

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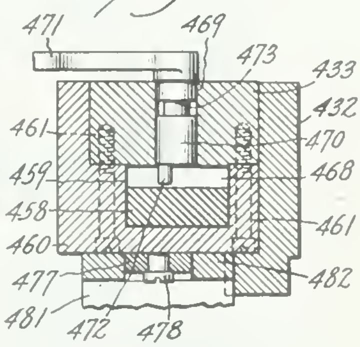

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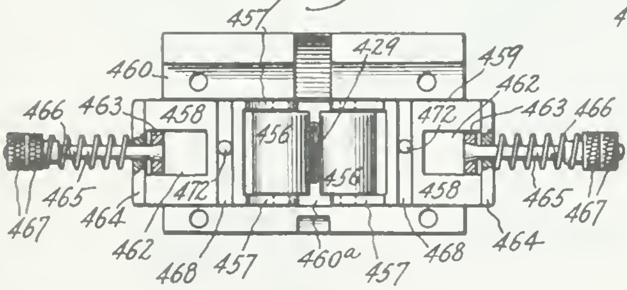

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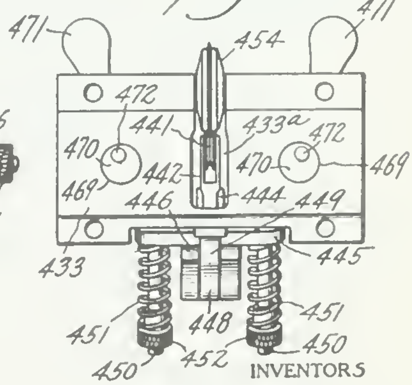

WITNESS

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 49.

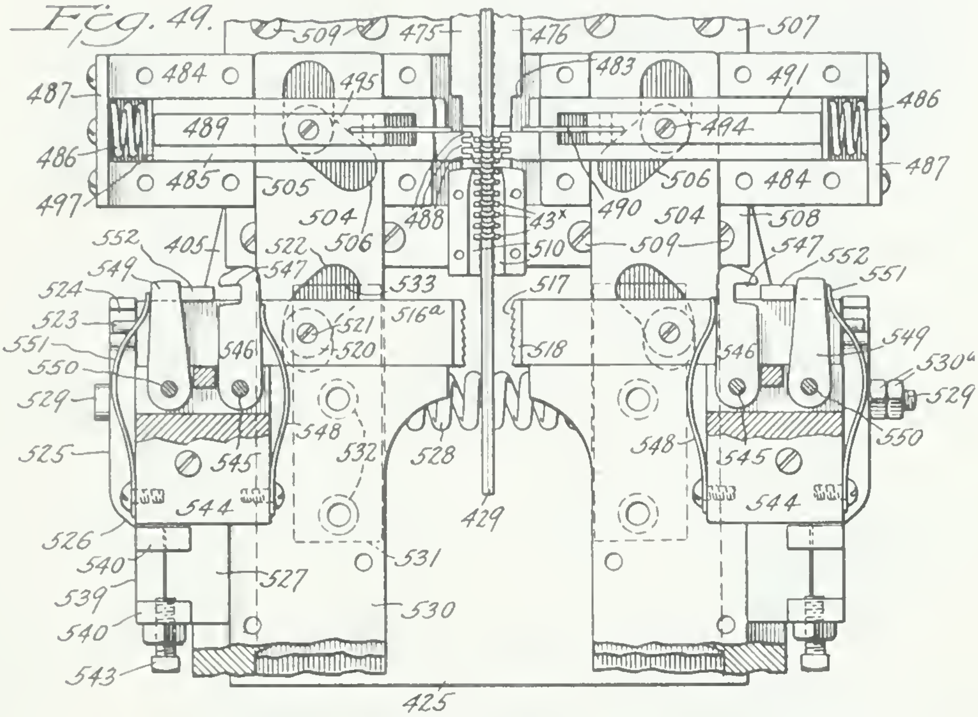
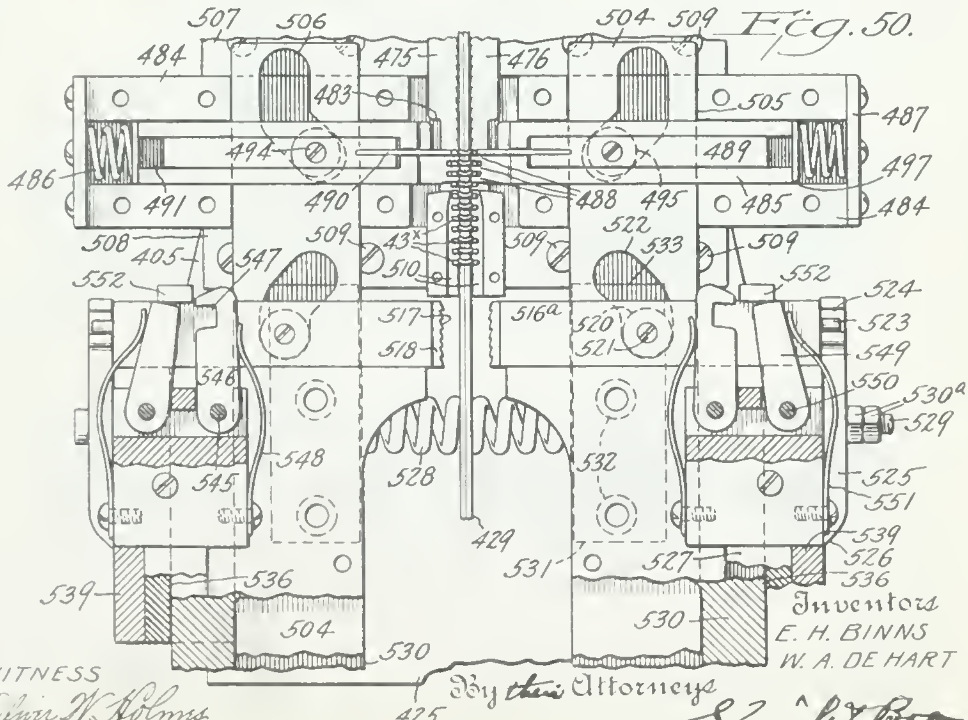


Fig. 50.



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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 51.

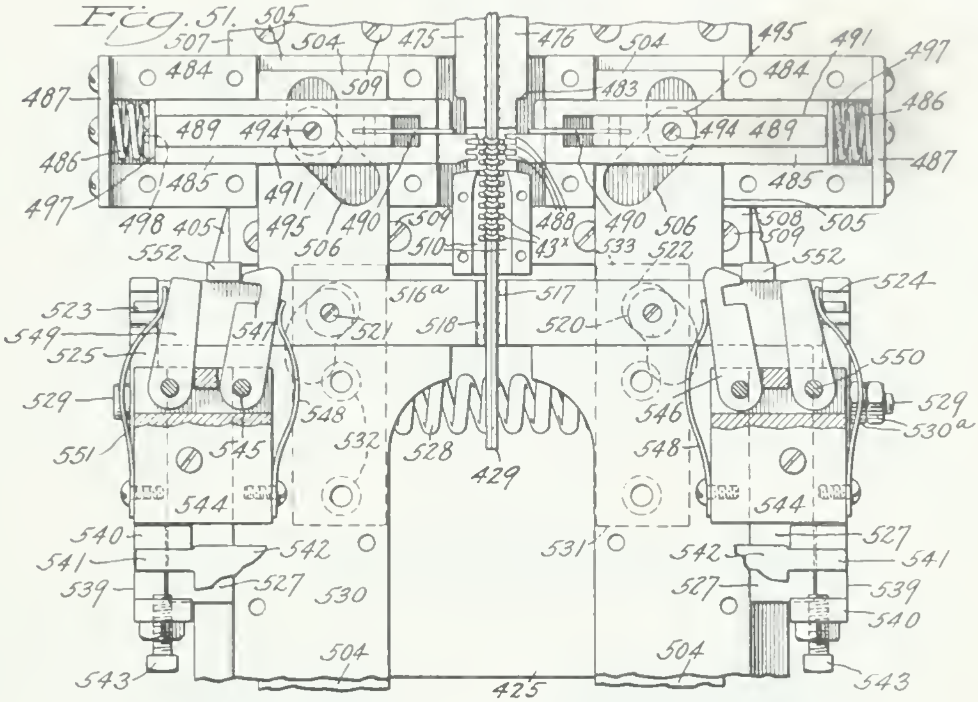
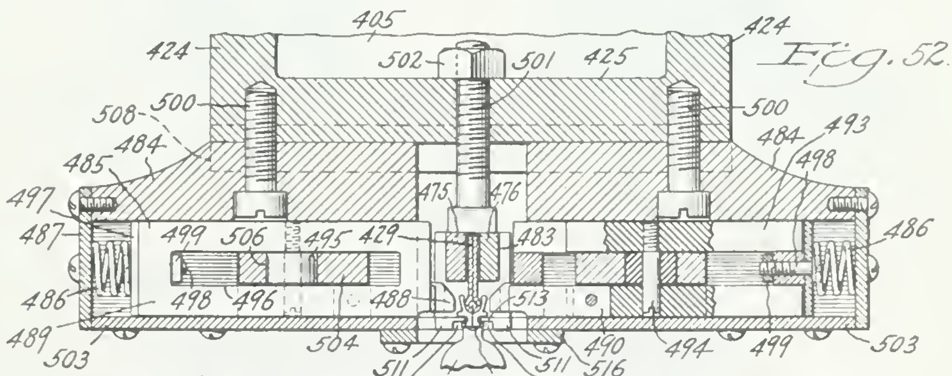


Fig. 52.



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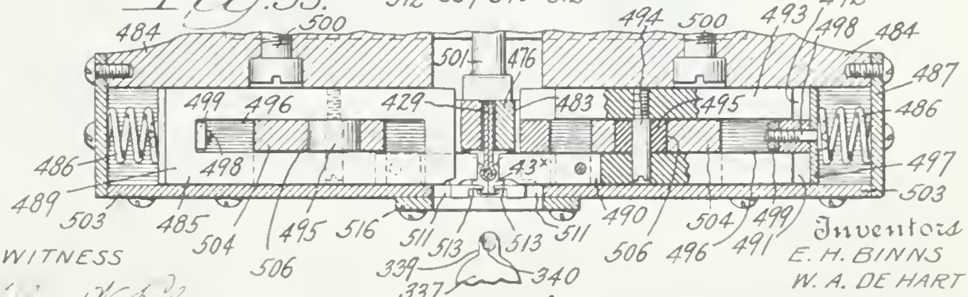

WITNESS

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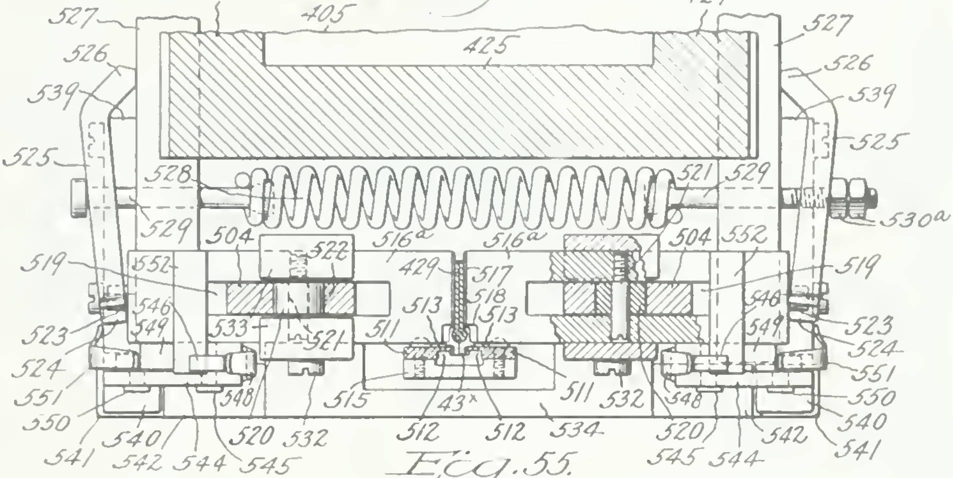
Fig. 54.



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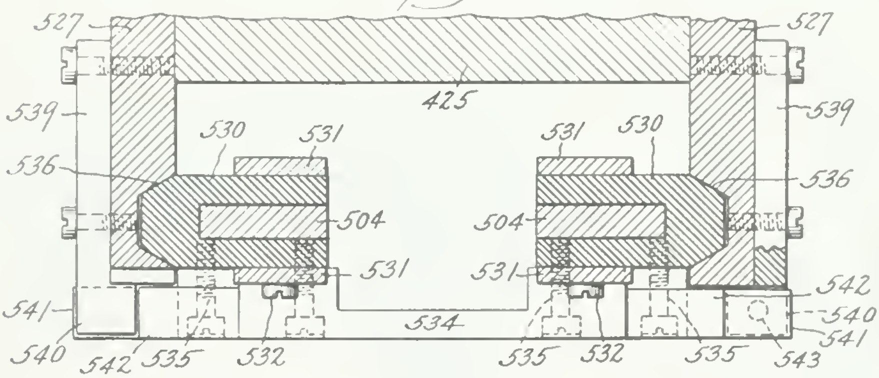

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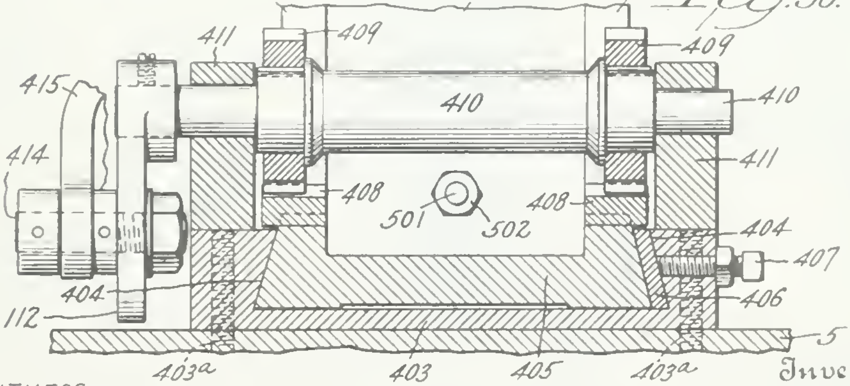

WITNESS

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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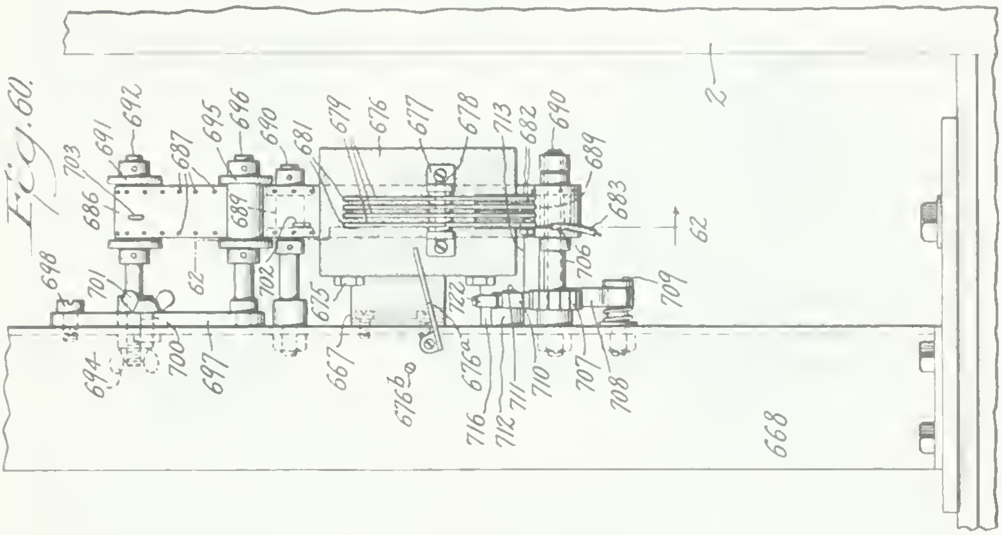

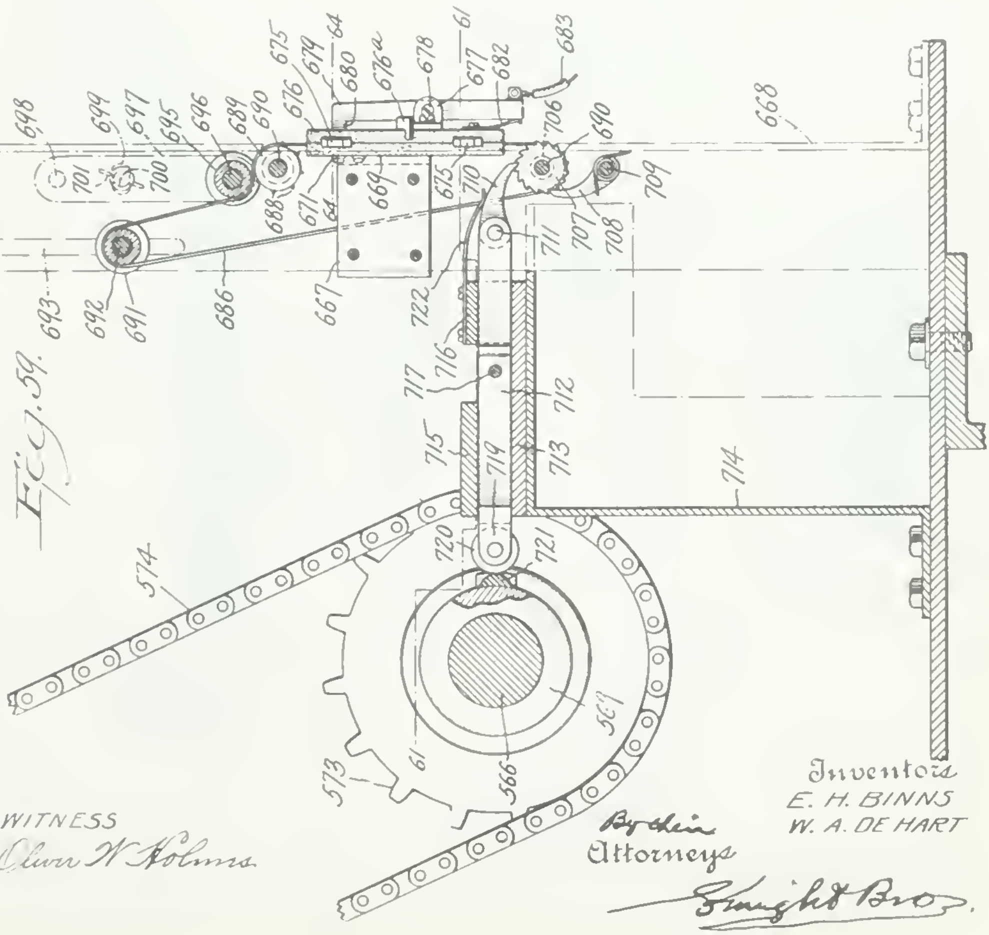

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Dec. 31, 1935. E. H. BINNS ET AL 2,026,413

METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 61.

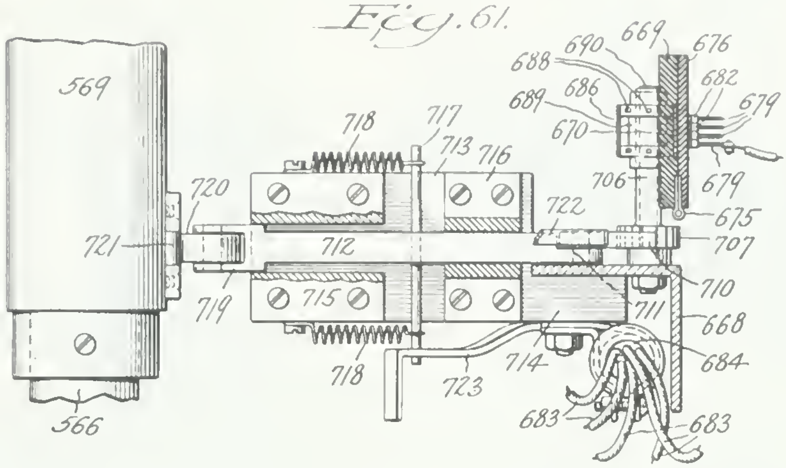
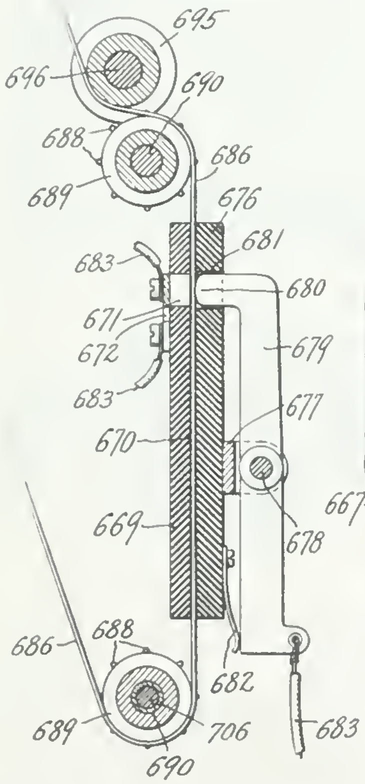


Fig. 62.



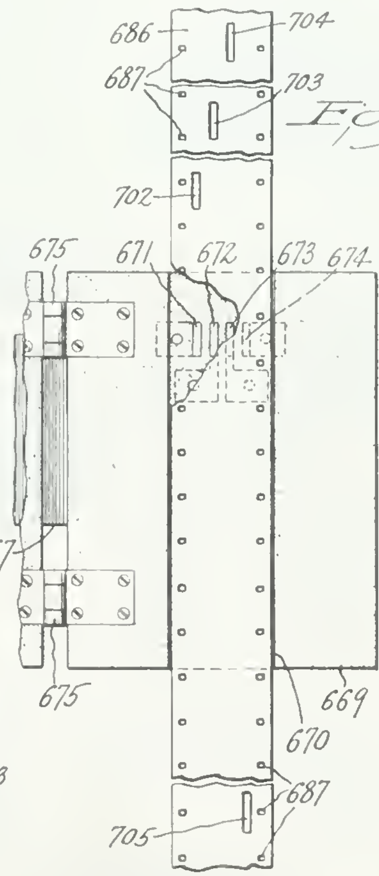


Fig. 63.

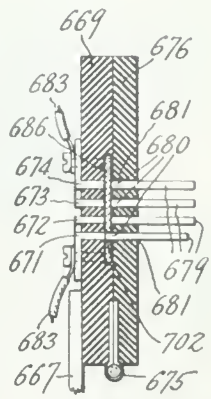


Fig. 64.

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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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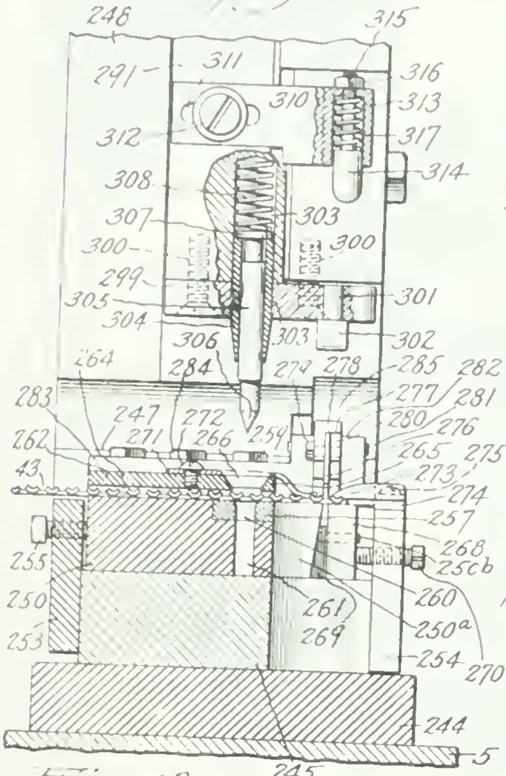
Fig. 65.



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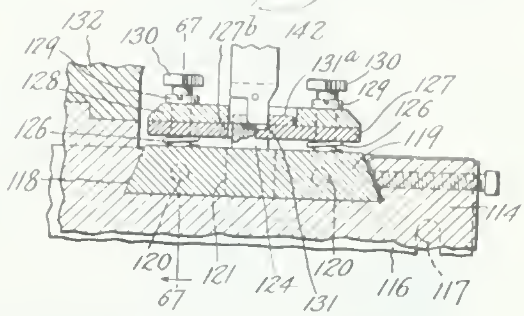

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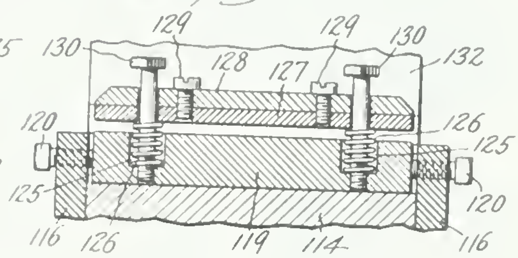
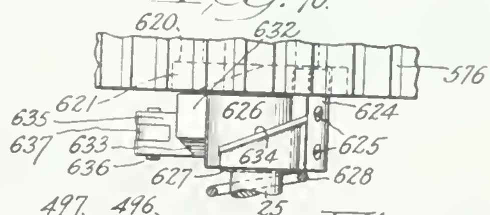


Fig. 70.



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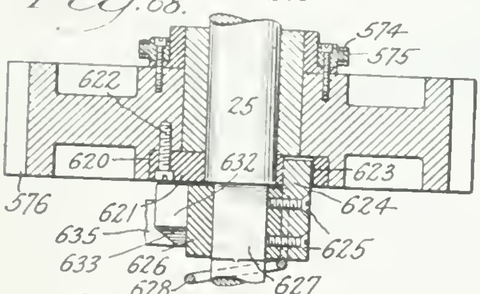

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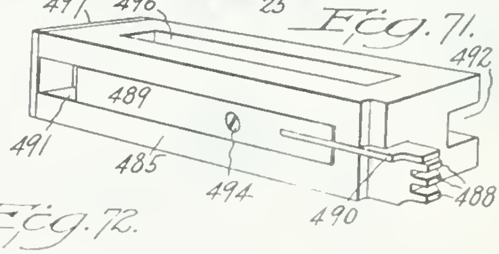

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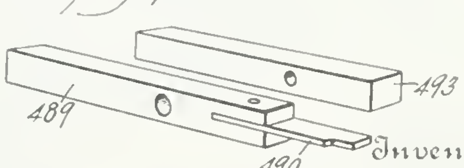

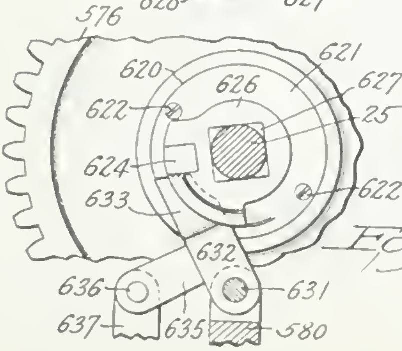

Fig. 69.

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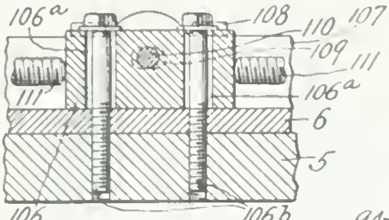


Fig. 76.

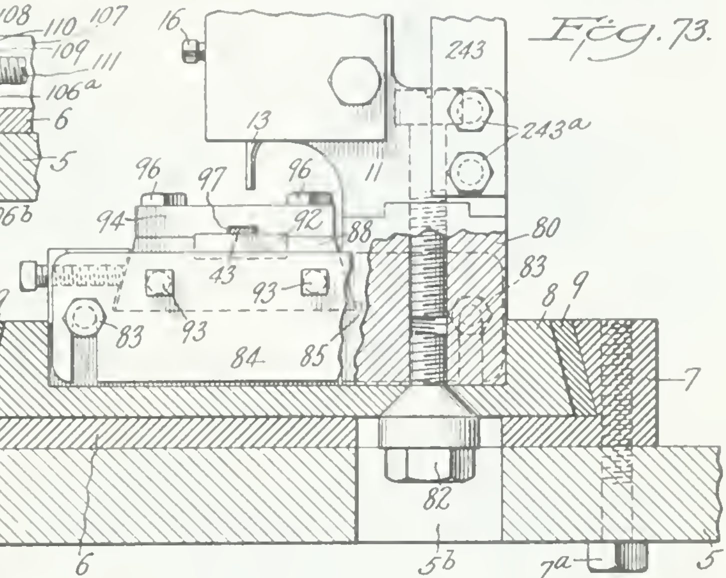


Fig. 73.

Fig. 74.

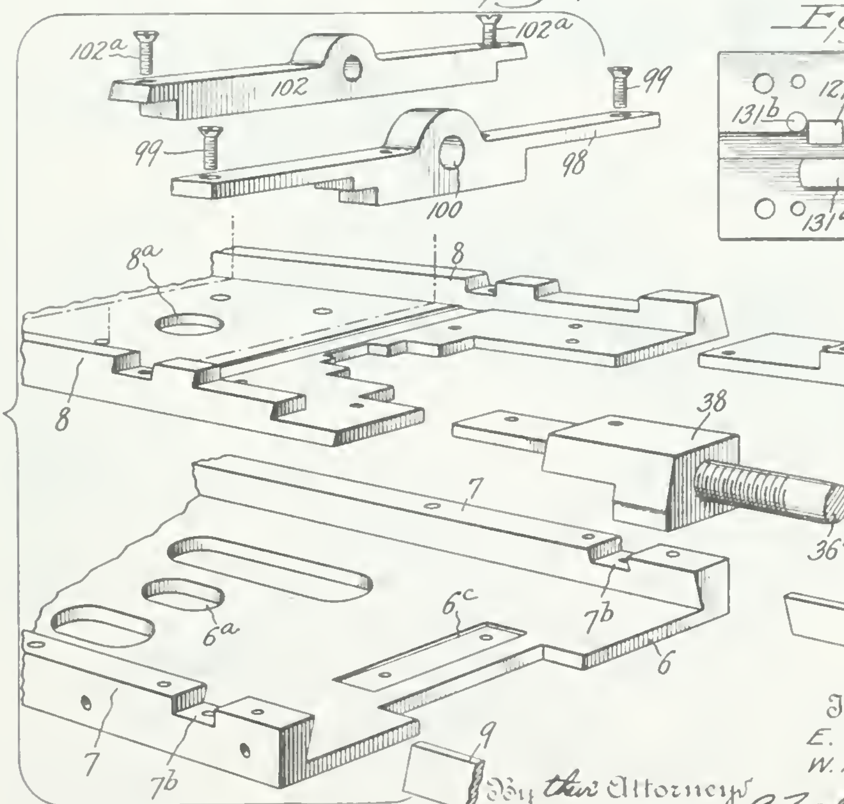
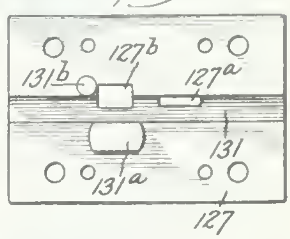


Fig. 75.



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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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Fig. 77.

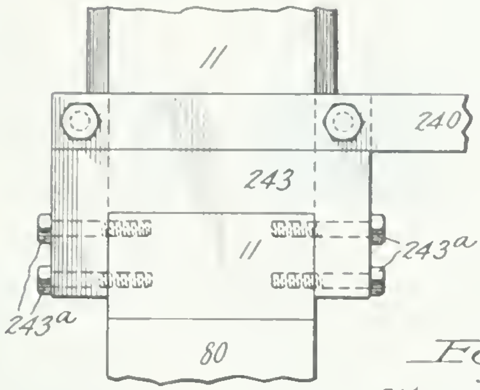


Fig. 82.

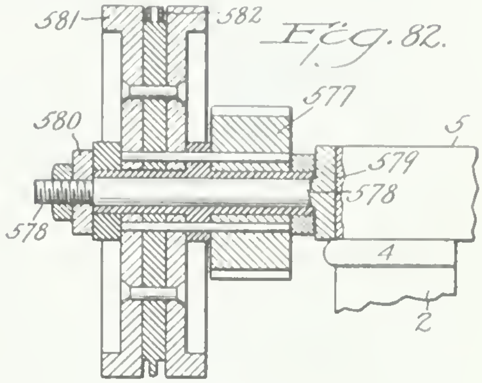


Fig. 78.

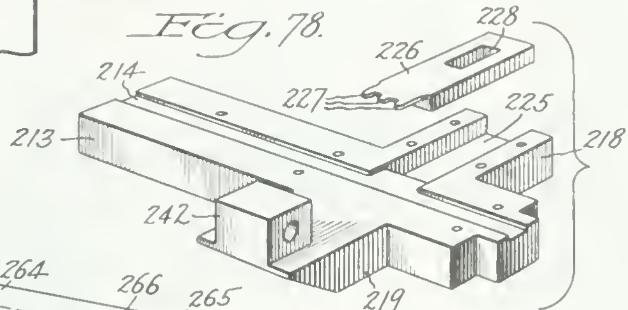


Fig. 79.

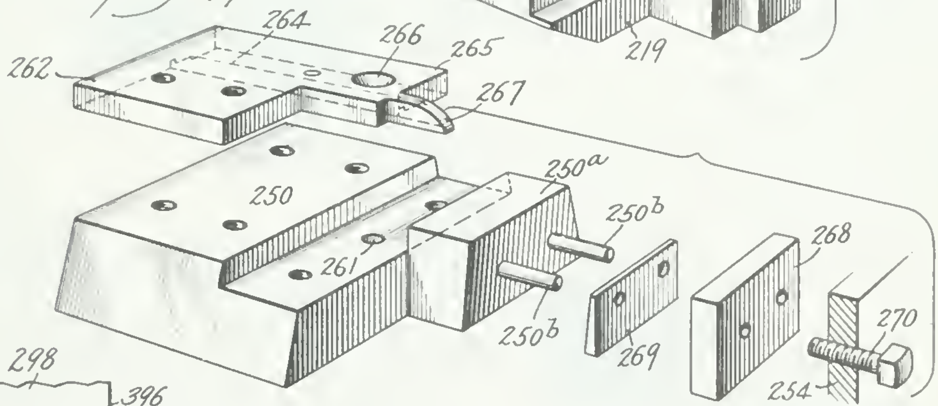


Fig. 81.

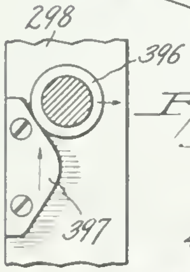
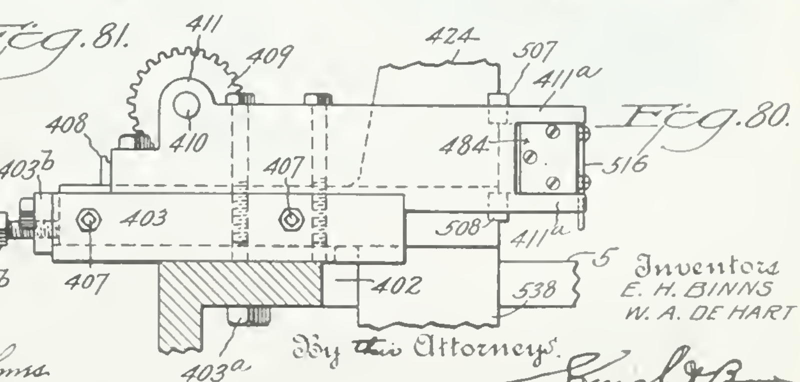


Fig. 80.



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METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

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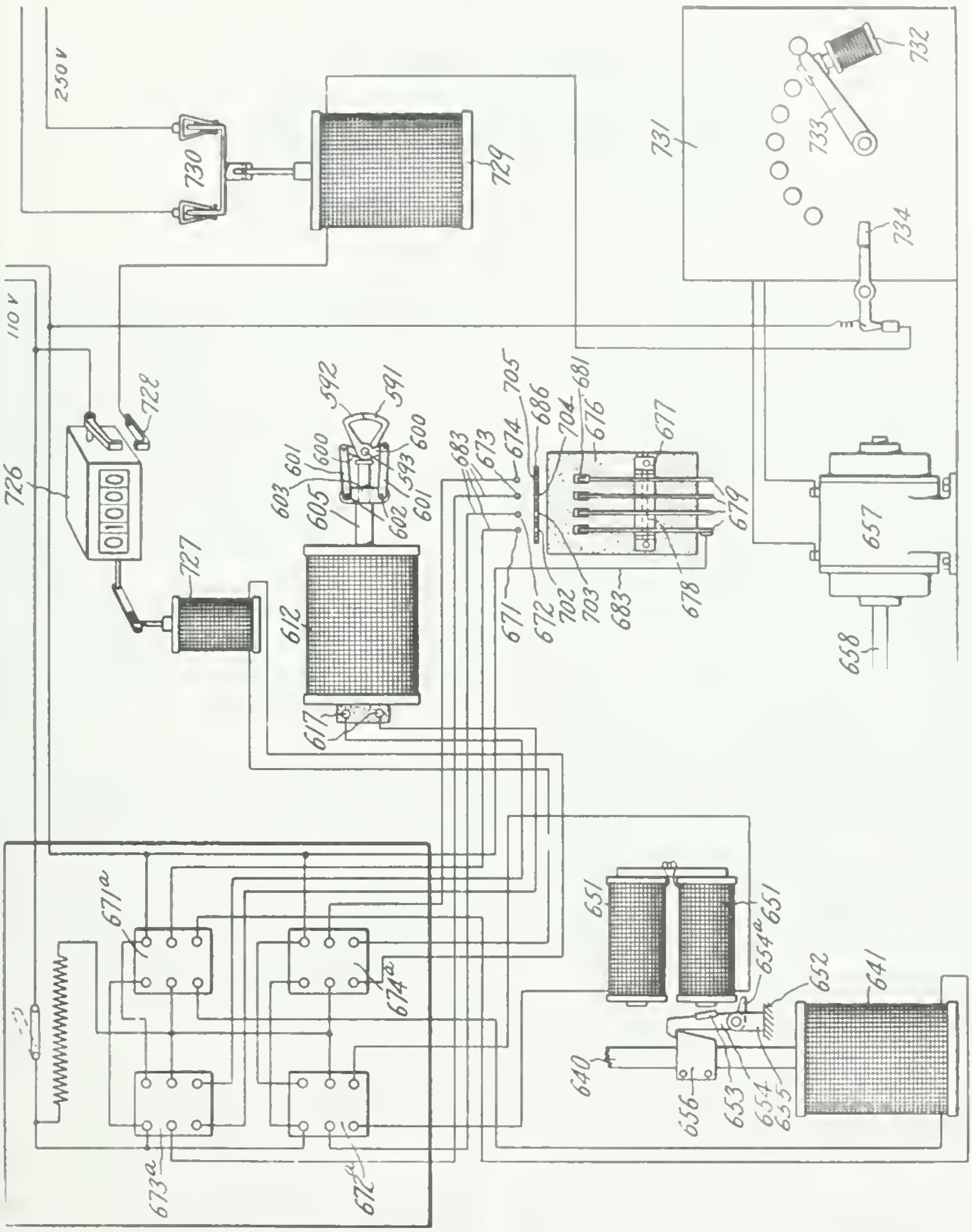

Fig. 83.

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By their Attorneys Knight Bros

Patented Dec. 31, 1935 2,026,413

UNITED STATES PATENT OFFICE

2,026,413

METHOD AND MACHINE FOR MAKING FLEXIBLE CLOSURES

Edward H. Binns, Pittsburgh, Pa., and William A. De Hart, Teaneck, N. J., assignors, by mesne assignments, to Hookless Fastener Company, Meadville, Pa., a corporation of Pennsylvania

Application November 21, 1930, Serial No. 497,174

103 Claims. (Cl. 153—1)

The present invention relates to improvements in automatic machinery and to improved methods for producing stringers of interlocking fastening devices for flexible closures of the type shown in Patents No. 1,553,499 of September 15, 1925, and No. 1,701,555 of February 12, 1929.

The improved machine comprises a plurality of punches for operating upon a blank strip of metal to form in successive stages the characteristic features of the individual interlocking fastening members, and tape forming and feeding mechanism acting upon a tape to fold it longitudinally into a two ply tape having a thickened rib or bead portion for the reception of the yoke ends of the fastening members that are clamped thereon. The folded form of the tape or stringer for the reception of the fastening members is an embodiment of the flexible closure structure covered by Patent No. 1,585,654 dated May 25, 1926.

These two sets of mechanisms,—the punch press mechanisms and the tape forming and feeding mechanisms,—are operated through a divided driving mechanism normally connected through an automatic control clutch so that both sets of mechanisms can be operated in unison for the continuous production of stringers or,—by shifting the connecting clutch,—the production of fastening members may be discontinued while the tape forming and feeding mechanism is continued in operation to supply blank parts of the formed tape between groups of fastening members. In this way the separation of groups of members upon the tape is effected, the feed of the tape being a uniform step by step operation whether fastening devices are being made and mounted upon the tape, or blank spaces between groups of members are being produced.

This arrangement of the two sets or groups of mechanisms which can operate together or with the fastener producing group disconnected is an important feature of the present invention. The importance of this divided operation of the two groups of mechanisms is due partly to the provision of an automatic control which maintains the joint operation of the mechanisms for a proper period to produce stringers with a predetermined number of fastening devices and, at the completion of a group of said devices of the desired number or length of stringers, acts through suitable means to arrest the action of the mechanisms for forming fastening members while the formation and feed of the folded beaded tape is kept up at the uniform rate of speed,—and upon the feed of a sufficient length of blank tape or stringer to again throw into action the fastener forming mechanisms to start a new group of fastening members.

Associated with the two sets of mechanisms referred to is a cut-off mechanism which is also actuated by the automatic control to cut the formed tape or stringer between groups of fastening members, to produce the desired length of stringers with the proper number of fastening members and extra blank ends of folded two ply tape.

The present invention includes, in addition to the above recited main features, improved constructions and arrangements of parts to insure accuracy and rapidity of operation of the machine in performing its work. The blank strip of metal is fed through the machine by a step by step motion induced through the operation of one of the punch presses which is mounted on a reciprocating bed and intermittently moved forward a step while the punches are in engagement with the strip and retracted to initial position while the punches are withdrawn,—the strip being held against rearward movement by suitable intermittently acting clamping means.

The improved fastener members are formed in a continuous strip or connected series by which they are fed and controlled until they are cut off as individual members. At the cut-off point each successive individual member is gripped rigidly by a carrier and conveyed to position for clamping it upon the beaded edge of the prepared folded carrier tape or stringer. The tape is drawn through the folding and forming devices by a step by step feeding mechanism mounted upon a reciprocating carriage by which the formed beaded edge of the folded tape is moved laterally into the forwardly presented open jaws of the finished fastening member supported firmly by the carrier gripper, clenching devices being thrown into action immediately thereafter for clamping the jaws of the fastener member upon the tape.

The improved machine is preferably automatic in its operation. The automatic controlling mechanism may be of any approved type but is preferably of the electrical type in which each important part of the mechanism is thrown into or out of action by the operation of an electro-magnet controlled through contact devices which are caused to function at the proper time by the mechanical operations that are controlled. The machine is driven by an electric motor receiving current through a rheostat or starting device and main supply switch as is usual; the rheostat lever being preferably under the control of a counting device of suitable construction, which, upon the completion of a count of the desired number of complete stringers produced by the machine, will actuate the rheostat lever for throwing out the motor and stopping the machine. The automatic clutch which connects the divided driving mechanisms operating the presses for producing fastener-members and the stringer forming and feeding mechanism is preferably controlled by two electromagnets, one of which releases the clutch for connecting up the divided drive mechanism while the other holds the clutch-operating devices in clutch released position until the clutch is to be thrown out to permit the stringer forming and feeding mechanism to operate alone. A third electromagnet controls the cutoff shears that sever the tape between groups of fastener members.

These several electrical controls are preferably in circuit with a group of contacts normally separated by an endless band of insulating material which is fed in a step-by-step manner one step for each revolution of the machine, said band having perforations formed in it at proper intervals to permit contact through the desired set of contact devices to operate the controlling magnets at the proper times to produce the desired results.

A still further object is to provide an improved method for forming separable fastener members wherein said members are substantially formed while connected together in a strip of metal.

In order that the invention may be fully understood it will first be described with reference to the accompanying drawings and the novelty thereafter more particularly pointed out in the annexed claims.

In said drawings:—

Figure 1 is a front elevation of the improved machine for producing stringers for flexible closures;

Figure 1*a* is a detail sectional view, taken on the line 1*a*—1*a* of Figure 1, showing the chip removing brush;

Figures 2 and 2*a* represent, taken together, a plan view of the said machine, Figure 2 representing the right hand portion of the machine, while Figure 2*a* represents the left hand portion of the same;

Figure 2*b* is a detail sectional view taken on the line 2*b*—2*b* of Figure 2;

Figure 3 is a left end elevation of the improved machine;

Figure 4 is a rear elevation of the left hand end of the machine;

Figure 5 (Sheet 21) is a partial end elevation of the right hand end of the improved machine;

Figure 6 is a vertical transverse sectional view taken on the line 6—6 of Figure 1;

Figure 7 is a partial vertical central longitudinal sectional view of the machine;

Figure 8 is a detail sectional view taken on line 8—8 of Figure 7 showing the cut-off device for severing individual fastener-members from the strip;

Figures 9 and 10 are detail perspective views of parts of said cut-off mechanism;

Figure 11 is a vertical transverse sectional view of the machine taken on the line 11—11 of Figure 1 and showing particularly the buffing mechanism;

Figure 12 is a detail sectional plan view illustrating the bed-plates of the first three punch presses and the operating mechanism for the reciprocating bed of the first punch press;

Figure 13 is a detail vertical longitudinal sectional view taken on the line 13—13 of Figure 12;

Figure 14 is a detail vertical transverse sectional view taken on the line 14—14 of Figure 12;

Figure 15 is an enlarged detail vertical longitudinal sectional view showing the first three punch presses;

Figure 16 is a detail plan view of the bed portion of press No. 1, part of the punch guiding and stripping plate being broken away to show the work;

Figure 17 is a view similar to Figure 16 showing the bed portion of press No. 2;

Figure 18 is a view similar to Figures 16 and 17 showing the bed portion of press No. 3;

Figure 19 is a detail vertical longitudinal sectional view of parts of press No. 1 indicating the relation of the punches to the metal blank strip extending over the bed-plate;

Figure 20 is a detail plan view of the blank strip upon the bed-plate of press No. 1 showing the three punches in cross-section in the blank strip;

Figure 21 is a detail vertical longitudinal sectional view of parts of press No. 2 illustrating the action of the male and female dies upon the metal blank strip;

Figure 22 is a detail plan view of the female die members of Figure 21 beneath the blank strip;

Figure 23 is a horizontal sectional view taken on the line 23—23 of Figure 21;

Figure 24 is a detail vertical transverse sectional view illustrating one pair of male and female dies of press No. 2 as shown in Figure 21;

Figure 25 is a detail sectional elevation of the other pair of male and female dies of press No. 2, shown in Figure 21;

Figure 26 is a detail vertical longitudinal sectional view illustrating parts of press No. 3 and the connected series of fastener members upon which the punch of press No. 3 imparts the final work;

Figure 27 is a detail plan view of the work upon the bed-plate of press No. 3, showing the final punch in cross-section in the work;

Figure 28 is an enlarged detail vertical transverse sectional view taken on the line 28—28 of Figure 1 and showing press No. 3;

Figure 29 is a detail perspective view of the pilot or gauge plate of press No. 3;

Figure 30 is a vertical transverse sectional view taken on the line 30—30 of Figure 7 showing parts of the auxiliary feed and press No. 4 by which the auxiliary feed is operated;

Figure 31 is a plan view, partly broken away, of the mechanism shown in Figure 7;

Figure 32 is a vertical transverse sectional view taken on the line 32—32 of Figure 31;

Figure 32*a* is an enlarged detail transverse sectional view of the cutoff knife for cutting off fastener members;

Figure 33 is a view similar to the main part of Figure 32 showing the closed position of the operative parts;

Figure 34 is a detail front elevation of the carrier for cutoff fastener members;

Figures 34*a* and 34*b* are enlarged detail sectional views of the gripper which grips the fastener members;

Figure 35 is a vertical sectional view taken on the line 35—35 of Figure 31;

Figure 36 is a view similar to Figure 35 showing the main parts in shifted position;

Figure 37 is a detail sectional view taken on the line 37—37 of Figure 38;

Figure 38 is a rear face view of the tape forming, feed and associated devices, part being removed and part being shown in section;

Figure 39 is a vertical sectional view taken on the line 39—39 of Figure 38;

Figure 39a is a detail perspective view of one of the tape-feeding gripper bars;

Figure 39b is a perspective view of a section of folded tape indicating two spaced groups of fastener members;

Figure 39c is an enlarged perspective view of a single detached fastener member;

Figure 40 is a detail transverse sectional view taken on line 40—40 of Figure 38;

Figure 41 is a detail vertical sectional view taken on the line 41—41 of Figure 38;

Figure 42 is a detail sectional view taken on the line 42—42 of Figure 39;

Figure 43 is a detail plan view of the upper portion of the tape folding and forming device;

Figure 44 is a rear view of the same;

Figure 45 is a plan view, partly broken away, of the spring actuated tape pressing rolls, the device being detached from the rest of the mechanism for the purpose of clearly illustrating it;

Figure 46 is a perspective view of one of said tape pressing rollers and its supporting carrier;

Figure 47 is a sectional view taken on the line 47—47 of Figure 44;

Figure 48 is an underneath plan view of the tape folding and forming mechanism in the plane of separation from the tape pressing rollers illustrated in Figure 45;

Figures 49, 50, and 51 are detail views in rear elevation showing the clencher and member spacing devices and tape-feeding devices, the parts being shown in progressive positions in the several views to illustrate the operation of said devices;

Figures 52 and 53 are horizontal sectional views taken on the line 53—53 of Figure 38 and showing two positions of the mechanism for clamping the fastener members upon the beaded edge of the folded tape;

Figure 54 is a sectional view taken on the line 54—54 of Figure 38;

Figure 55 is a detail sectional view taken on the line 55—55 of Figure 38;

Figure 56 is a detail sectional view taken on the line 56—56 of Figure 2a;

Figures 57 and 58 are respectively a vertical sectional view and a bottom plan view of the automatically controlled tape cut-off mechanism;

Figure 59 is a transverse vertical sectional view of the automatic control mechanism;

Figure 60 is a detail front elevation of the main parts of the same mechanism;

Figure 61 is a sectional view taken on the line 61—61 of Figure 59;

Figure 62 is a vertical sectional view taken on the line 62—62 of Figure 60;

Figure 63 is a detail fragmentary view illustrating the circuit controlling band of the automatic controlling mechanism;

Figure 64 is a detail sectional view taken on the line 64—64 of Figure 59;

Figure 65 is a vertical longitudinal sectional view through press No. 4 showing the strip-gauging pilot to the member cutoff and the carrier gripper;

Figure 66 is a transverse sectional view taken on the line 66—66 of Figure 17;

Figure 67 is a detail sectional view taken on the line 67—67 of Figures 17 and 66;

Figure 68 is a detail horizontal sectional view illustrating the automatic controlling clutch dividing the driving mechanisma for the punch presses and tape folding and feeding mechanism;

Figure 69 is a detail face view of said controlling clutch;

Figure 70 is a detail plan view of said clutch;

Figures 71 and 72 are detail perspective views of the mechanism for clamping fastener-members upon the beaded edge of the folded tape and for gauging the spacing between successive fastener-members upon said tape;

Figure 73 is a detail vertical transverse sectional view taken on the line 73—73 of Figures 2 and 15;

Figure 74 is a view in perspective of disassembled parts of the bed-plate and reciprocating bed of press No. 1;

Figure 75 is a detail plan view of the stripper plate of press No. 2;

Figure 76 is a detail vertical transverse sectional view taken on the line 76—76 of Figure 12;

Figure 77 is a detail rear view of part of press No. 1 showing the connection of operating bar extending to the auxiliary feed;

Figure 78 is a detail perspective view of the reciprocatory slide of the auxiliary feed;

Figure 79 is a detail enlarged perspective view of disassembled parts of press No. 4;

Figure 80 is a detail side view of an auxiliary fixed arm of the supporting frame for the reciprocating tape-former;

Figure 81 is a detail face view of the cam for operating the gripper trip of the fastener-member carrier;

Figure 82 is a detail vertical sectional view taken on the line 82—82 of Figure 2a;

Figure 83 is a diagrammatic view illustrating the electrical control of the improved machine;

In specifically describing the improved machine the mechanisms will be referred to in their natural order, starting with the punch and die mechanisms which act successively upon an intermittently fed continuous metal strip-blank to form individual interlocking closure members; the first punch press being reciprocable to also act as the main step-by-step feed for the metal strip-blank; then the mechanism for severing completely forming individual closure fastener-members from the continuous metal strip; the carrier mechanism for taking successive severed members from the cutoff mechanism and moving them to a point where they are clamped upon the beaded flexible tape or stringer; the mechanism for longitudinally folding a tape and forming it with a beaded edge and feeding the beaded folded tape and presenting it intermittently in step-by-step movements within the open jaws of fastening closure members which are clamped upon its beaded edge; means associated with the tape-forming and feeding mechanism for spacing successive closure members and for clamping them upon the beaded edge of the folded tape; power mechanism acting through an automatic clutch which divides the power between the camshaft which operates the punch and die and other mechanisms acting upon the metal strip-blank and closure members formed therefrom, and the tape-forming, feeding and member-clamping mechanisms, said divided feed being so arranged and controlled that all of the mechanisms can be caused to operate in proper unison and sequence to form closure members and clamp them upon the folded tape, or the formation of closure members may be arrested while the tape-forming and feeding mechanisms continue in operation to produce blank parts of the formed tape between groups of attached closure members; automatically controlled cutoff mechanism for severing the folded tape or stringer between groups of closure members; and finally automatic controlling mechanism by which the machine is caused to produce flexible closure stringers with the desired number of closure members and blank ends of tapes or stringers.

There are many detail devices forming parts of, or associated with, the general mechanisms referred to, all of which will be specifically described in their proper relationship with reference to the grouping of mechanisms and the accompanying drawings.

The machine embodying the present invention may be mounted upon any suitable framework. In the embodiment illustrated in the accompanying drawings the machine is mounted upon a heavy framework comprising the two end-frames or standards 1 and 2 having upon their upper ends the solid cross-bars or girders 3, 4 upon which is rigidly mounted a heavy steel table or platform 5. The table 5 is preferably of solid steel having integral downwardly presented strengthening flanges upon its sides and ends. This rigid framework is suitably braced by the shafts, supporting brackets and other rigidly attached parts hereinafter specifically referred to so that the machine parts will be substantially supported in their operative relation.

Punch and die forming and feeding mechanisms of press No. 1

The metal closure members are formed from a metal strip-blank by the successive action of punches and dies mounted in a series of three presses arranged upon the table or platform 5 at the right-hand or leading-in end of the machine shown in Figures 1, 2 and 5 of the drawings.

A heavy shallow steel tray 6 open at its ends and having heavy upstanding side flanges 7, is rigidly secured to the right-hand end of the table or platform 5 in the central longitudinal plane thereof, by means of heavy bolts 7a which are inserted from beneath the table or platform 5 and threaded into the tray 6 and its flanges 7 as best shown in Figure 73 on Sheet 25 of the drawings. This tray 6 affords a supporting bed for the three presses presently to be described, press No. 1 of which has imparted to it a short to and fro motion and, when the metal blank is engaged by its punches, constitutes the main feed mechanism for passing the metal strip blank in a step-by-step motion through the machine.

Press No. 1 (best shown in Figures 1, 2, 5, 12, 13, 14, 15, 73, and 74 of the drawings), has a rectangular bed-plate 8 sliding upon the base tray 6 between the undercut inner faces of flanges 7, the side edges of the bed-plate 8 being bevelled and shims 9 being mounted between the bevelled edges of bed-plate 8 and the side flanges 7. Set screws 10 are threaded through the front flange 7 and engage one of the shims 9 to accurately confine the bed-plate 8 of the press in position and at the same time allow freedom of motion for its reciprocation. The press standard 11 extends upwardly from the press block 80 mounted upon the bed-plate 8 upon which it is firmly supported, as hereinafter more fully described. This standard 11 of press No. 1 carries a vertically reciprocating plunger 12 in the lower end of which are secured the three punch members 13, 14, and 15, said punch members being removably secured in the plunger 12 by means of set screws 16. The reciprocating plunger 12 carries at its upper end a slotted yoke 17 embracing an anti-friction roller 18 carried by pin 19 supported in the bifurcated end 20 of the press operating lever 21 which is pivoted upon the bracket 22 secured to the table 5 and engaged at its rear end 23 by a cam 24 mounted upon the main cam-shaft 25 extending from end to end along the rear edge of the table or platform 5, said cam-shaft being suitably supported and journalled in bracket-bearings 26 secured to the table or platform 5. In this operative connection between the cam 24 and reciprocating plunger 12 of press No. 1 it will be understood that the arms of the bifurcated end 20 of lever 21 are sufficiently spaced to permit the free movement of plunger 12 on roller 18 upon the reciprocation of press No. 1 in accomplishing the feed of the metal strip-blank.

Press No. 1 is given an intermittent forward feeding motion with the punches in engagement with the blank and an intermittent return movement to initial position with the punches released from the blank, said movements being accomplished by means of the rocker-arms 27 extending upwardly from and keyed to the rock-shaft 28 which is freely journalled in the bracket-bearings 29 bolted to the end of the table or platform 5, as shown in Figures 1, 2, 5, 12, and 13. This rock-shaft 28 has secured to it a downwardly projecting arm 30 to which is pivoted a rod 31 extending through a bracket 32 and supporting a coil spring 33 confined upon the rod 31 against bracket 32 by means of nuts 34 threaded upon rod 31. The rock-shaft 28 also carries an upwardly projecting rock-arm 35 which is engaged by a cam 36 mounted upon the main cam-shaft 25.

The rocker-arms 27, above referred to, are formed with bifurcated upper ends 27a which straddle two bolts 36a between pairs of oppositely presented flanged bushings 37 mounted upon said bolts 36a. The bolts 36a are threaded into blocks 38 rigidly secured to the reciprocatory bed-plate 8 from which said bolts extend horizontally above the transverse rock-shaft 28. The bolts 36a have threaded upon them adjacent to the blocks 38, the adjustable nuts 39 and at their outer ends adjustable nuts 40, coil springs 41 being confined between the nuts 39 and the annular flanges of the inner bushings 37 while coil springs 42 are confined between the nuts 40 and the outer flanged bushings 37. The arrangement of described cushioning connections between the rock-arms 27 and press No. 1 is for the purpose of affording a yielding excess of motion to the feeding action of press No. 1 to ensure accuracy in the feeding stroke and maintain the press under tension in its extended position of feed until the metal strip-blank is engaged and held by other instrumentalities presently to be referred to.

43 represents the flat metal strip blank which may be supplied to the machine from any suitable source such as a spool or reel (not shown) from which it can readily be drawn into the machine as needed.

44 is a bracket rigidly bolted to the end of table or platform 5 and formed with a horizontal slot or opening 45 for the passage of the strip-blank 43. This bracket 44 carries two hori-

zontally extending-bracket arms 46 in the free ends of which is mounted a transverse pin 47 upon which is pivoted the bifurcated lower end of a link 48 carrying a removable wear block 49 having a slot or passageway 50 extending through it in alignment with guide opening 45 for the free passage of the metal strip-blank 43. A lower roller 51 is freely journalled upon the pin 52 mounted in bracket-arms 46 and is supported thereby with its periphery in the horizontal plane of feed of metal strip-blank 43 as it passes through feed-openings 50 and 45 above referred to. Cooperating with the lower roller 51 is an upper tension-roller 53 freely journalled upon a pin 54 carried between a pair of arms 55 pivoted at 56 upon the bracket 44 and extending horizontally to a point above the blank guiding link 48. A tension rod 57 passes freely through an opening in a bridge piece 58 connecting arms 55 and is threaded into the upper end of the guide link 48. This rod 57 carries a coil spring 59 confined between the collars 60 by a nut 61 threaded upon the upper end of rod 57. The spring 59 applies tension to the pivoted frame (arms 55 and bridge 58) carrying the roller 53 holding said roller down upon the blank 43 at the point of its support upon the lower roller 51.

Upright members 62 are secured to and project upward from the pivoted arms 55, said upright members 62 being connected at the top by a crossbar 63 (see Figures 1 and 5 of the drawings). An adjusting screw 64 is threaded through the crossbar 63 and carries at its lower end a brake block 65 which engages the periphery of the upper roller 53. A lock nut 66 upon screw 64 engages crossbar 63 and holds the brake lock in the desired adjusted relation to the roll 53. In this maner the tension roller 53 is pressed against the blank 43 by the pressure of spring 59 and the freedom of its rotation upon its axis is further restricted by the adjustment of the brake block 65.

The metal strip-blank 43 passes from the guide slots 45 in bracket 44 through a shallow guide channel 67 formed in the upper face of a heavy plate or block 68 which is rigidly secured to the upright side flanges 7 of tray 6 carried by the table or platform 5. 69 is a clamp member rigidly secured at 70 to the clamping bar 71, which bar is pivoted at its forward end 72 in the bifurcated bracket 73 which is secured by screws 74 to the upper face of the plate or block 68. The clamping bar 71 extends rearwardly and passes freely between two upright guide flanges of bracket 75 which is secured to the plate or block 68. The rear end of the clamping bar 71 carries an antifriction roller 76 which operates upon the cam 77 carried by the cam-shaft 25. A coil spring 78 connects the clamping bar 71 with a bracket 79 secured to the table or platform 5. The shape of the cam 77 as shown in Figure 5 of the drawings is such that the clamp member 69 will be held down in engagement with the metal strip-blank 43 for the greater part of a revolution of the cam-shaft, the high part of the cam 77 acting to momentarily raise the clamp from the blank while it is given a forward feeding impulse by the means hereinafter described.

Referring particularly to Figures 2, 12, 13, 14, 15, 16, 73, and 74 of the drawings, it will be observed that the reciprocatory flanged tray 8 of press No. 1 carries a heavy block 80 having a central opening 81 registering with a similar opening 8a of the bottom plate of bed-plate 8. The fixed tray 6 and the table or platform 5 have openings through them at 6a and 5a respectively which are somewhat larger than the openings 81 and 8a just referred to to ensure free discharge of chips from these latter openings in all positions of the reciprocating press No. 1.

The block 80 referred to has mounted upon it the upwardly projecting standard 11. The specific mounting of this standard in press No. 1 is similar to that of the third press (Figure 28) and is best shown in Figure 73.

The heavy press block 80 is rigidly secured in the recessed upper face of the reciprocatory bed-plate 8 by means of heavy screws 82, one of which is shown in Figure 73, Sheet 25. These screws 82 are preferably inserted from beneath, the table or platform 5 being slotted at 5b and 6c also indicated in dotted lines in Figure 12 of the drawings. The transverse faces of block 80 have threaded into them machine screws 83 which pass through the vertical slots of plates 84 and secure said plates removably to the block 80. The block 80 is formed with a deep dovetail recess 85 to receive the die plates and pillar blocks that are removably mounted therein. There are three pillar blocks indicated at 86, 87, and 88 having chip discharging openings through them leading into the opening 81 of block 80. These pillar blocks are separated by thin spacing strips 89, said strips projecting above the pillar blocks and serving also to separate the three die plates indicated at 90, 91, and 92, see Figure 15. Set screws 93 are threaded through the plates 84 and engage the faces of pillar blocks 86 and 88 for confining the pillar blocks in place and for adjusting the blocks and with them the die plates longitudinally of the machine. The die plates 90, 91, and 92 are surmounted by a cover plate 94 formed with punch receiving openings 95 directly above the openings through the die plates. This cover plate 94 as well as the die plates 90, 91, and 92 are securely fastened to the pillar blocks 86, 87, and 88 by means of vertical set screws 96 which pass through the cover and die plates and are threaded into the pillar blocks. Cover plate 94 has a guide groove 97 in its under face in the longitudinal line of punch receiving openings 95 and in the line of feed of the metal strip-blank 43 which passes between the cover plate and the die plates and is supported thereby for the action of the punches upon the blank.

It will be understood that the punch members 13, 14 and 15 are shaped to cooperate with the dies in punching parts from the metal strip-blank, the particular parts of the work performed by these punches and dies being hereinafter more fully described.

Beneath the plate or block 68 a transverse abutment bar 98 is rigidly secured in cutout notches 7b of flanges 7 of tray 6 by means of set screws 99, the central portion of said bar 98 being thickened and seated in shallow recess 6c in bottom of tray 6 where it is further secured by screw bolts 99a. Bar 98 is perforated at 100 to receive the reduced end of an abutment block 101 which is driven tightly into said perforation 100.

The reciprocatory bed-plate 8 of press No. 1 carries the transverse abutment bars 102 and 103 which are centrally perforated to receive the reduced ends of abutment blocks 104 and 105 which are driven into said perforations. These bars 102 and 103 are firmly seated in notches and recesses in the side and bottom walls of bed-plate 8 and are secured to the bed-plate by means of set screws 102a and 103a. The abutment block

104 is in line with the abutment block 101 with which it engages to limit the movement of press bed-plate 8 to the right. The abutment block 105 is formed with a transversely bevelled or inclined face that is adapted to contact with the bevelled face of an adjustable abutment block 106 which is mounted on the inner face of a transverse abutment bar 107 rigidly secured to the notched out flanges 7 of the fixed tray 6 by means of set screws 108, said bar 107 having formed in it a horizontal slot 109 to loosely receive a screw 110 that passes through said slot and is threaded into the adjustable abutment block 106, see Figure 76, Sheet 25. Abutment block 106 is formed with the slots 106*a* through which loosely pass the screw bolts 106*b* which pass through the bottom of tray 6 and are threaded into suitable openings in table 5. Oppositely arranged adjusting screws 111 are threaded through the upright flanges 7 of tray 6 and engage the ends of abutment block 106 for accurately determining the position of block 106 to cause it to arrest the feeding movement of bed-plate 8 of press No. 1. It will be understood that when block 106 is adjusted the screw bolts 106*b* and 110 are first loosened, then block 106 is adjusted by manipulating bolts 111, after which bolts 106*b* and 110 are tightened to secure block 106 in its adjusted position.

A consideration of the disassembled perspective view of Figure 74 (Sheet 25) with Figure 73 (same sheet) and Figure 12 (Sheet 8) will give a clearer understanding of press No. 1. The blocks 38 (by which the operating mechanism is connected to the reciprocating tray 8) are flanged and cut away to accurately fit the corners at the right hand end of tray 8 to which the blocks are secured by screws or rivets set in the matching perforations in the parts. The tray 8 with attached blocks 38 rests in stationary tray 6 with the top shoulders of blocks 38 operating to the right of abutment bar 98. The bottom wall of tray 8 is cut out or recessed to avoid interference with the central thickened portion of abutment bar 98.

The metal strip-blank 43 passes from press No. 1 through press No. 2 which carries two sets of male and female dies for acting upon and shaping the portions of the strip-blank that have been punched out by press No. 1.

Forming dies—press No. 2

Press No. 2 comprises a flanged bed 112 having outwardly flared side walls resting between the undercut side flanges 7 of the tray 6 and rigidly clamped therein by set screws 113. The flanged bed supports the closely fitting bed-block 114 which is rigidly secured therein by means of set screws 115 inserted from the bottom through the bed 112 to the block 114. Block 114 carries the removably mounted transverse plates 116 held in place by screw bolts 117 threaded into block 114 and engaging the plates 118 through vertical slots of the plates. The bed-block 114 is formed with a transverse recess 118 having undercut side walls to receive the die plate 119 secured in the desired adjusted position upon the bed-block by means of adjusting screws 120 passing through the transverse plates 116 and engaging edges of the die plate 119. The die plate 119 is formed with two cylindrical openings 121 and 122 to receive the cylindrical base blocks of the lower female die members 123 and 124 hereinafter more fully described. The die plate 119 is formed adjacent to its four corners with cylindrical recesses 125 in which are seated the coil expansion springs 126 upon which rests the stripper plate 127 having secured to it by means of machine screws 129 a cover plate 128. Headed guide rods 130 pass freely through guide openings in the stripper plate 127 and attached cover plate 128 and centrally through the coil expansion springs 126 and are threaded into and rigidly secured in the reduced holes in the bottom of recesses 125 of die plate 119.

The stripper plate 127 has a guideway 131 and aligned rectangular openings 127*a* and 127*b* to fit over the upwardly presented female die members of the die blocks 123 and 124 and the cover plate has a rectangular opening cut through it above the said openings in the stripper plate. The detail features of stripper plate 127 will be best understood by reference to Figure 75, Sheet 25, of the drawings. It will be observed that said stripper plate 127 is also formed with a rigid upwardly presented lug 131*a* at one side of guideway 131 and a cylindrical upstanding stud 131*b* at the opposite edge of guideway 131 and alongside of the die receiving opening 127*b*. The guide lug 131*a* supports the upper die member 142 against forward displacement and strain in its action upon the punched blank, while the guide stud 131*b* assists in maintaining the blank in accurate alignment in the guideway 131 during the action of the dies. The guideway 131 is formed in the upper surface of stripper plate 127 for the passage of the metal strip-blank 43 beneath cover plate 128 by which the blank is held for the action of the dies of press No. 2.

132 is the head or standard of press No. 2, it being mortised into the bed-block 114 and rigidly secured thereon by heavy anchoring screws (not shown) similar to screws 163 and 249, Figures 28 and 32 respectively. This head or standard 132 carries the usual vertically reciprocating plunger 134 having at its upper end a sectional slotted yoke 135 engaged by an anti-friction roller 140 upon the pin 136 mounted in the forked end of the operating lever 137 which is pivoted upon the bracket 138 secured to the table or platform 5 and is engaged at its rear end by an operating cam 139 mounted upon the cam-shaft 25. 141 and 142 are upper or male die members removably mounted in suitable sockets presented downwardly in the reciprocating plunger 134 and removably secured therein by set screws 143. Die members 141 and 142 cooperate with the dies carried by blocks 123 and 124 above referred to, and shape the punched-out parts of the metal strip-blank in the manner hereinafter more fully described. In this operation of press No. 2 it will be understood that the spring supported stripper plate 127 and attached cover plate 128 are carried downwardly by the metal strip-blank when press No. 2 operates, thereby permitting the male and female dies to properly shape the previously punched-out parts of the blank and when released from press No. 2 the springs 126 raise the attached plates 127 and 128 and strip the blank from the horns or projections of the lower die members.

Punch press No. 3

The metal strip-blank 43 passes from press No. 2 through press No. 3 which performs the final punching operation upon the blank. This press No. 3 comprises the flanged bed-plate 144 shaped to fit and secured between the undercut flanges 7 of tray 6 in substantially the same manner as described with reference to press No. 2, the bed-plate 144 being secured in position by set screws 145. The table or platform 5 has a discharge opening 5d and the tray 6 has a registering discharge opening 6b which register with a chip discharge opening 146 of bed-plate 144 and opening 147 of bed-block 148 which is secured to the bed-plate 144 by means of set screws 149 inserted from beneath bed-plate 144. The bed-block 148 carries transverse plates 150 removably secured by screw bolts 151 in the manner hereinbefore described with reference to the plates 118 of press No. 2. Bed-block 148 is formed with a longitudinal recess 152 having undercut walls in which rests the block 153 having flared side walls to closely fit the recess 152. Screw bolts 150a are threaded through transverse plates 150 and engage the opposite ends of block 153 to adjust its position with reference to the action of the punch of press No. 3. Screw bolts 154 threaded in block 148 engage the front bevelled face of block 153 to secure it in its adjusted place. Block 153 has a chip opening 155 discharging into opening 147. The die plate 156 is seated in the recessed upper face of the block 153 and surmounting the die plate 156 is a channeled cover plate 157 secured to block 153 by screw bolts 158. This cover plate 157 has an opening 159 to receive the punch member hereinafter referred to and a longitudinal guide channel 160 extending across said opening and the lower die plate 156, said guide being for the passage of the metal strip-blank 43 in proper relation to the punch of press No. 3. 161 is the head or standard of press No. 3 mortised at 162 to the bed-block 148 and rigidly secured to the bed-block by means of heavy screw bolts 163. This head or standard 161 has the usual vertically reciprocating plunger 164 having the sectional slotted yoke 165 at the top which is engaged by a pin 166 carried in the bifurcated forward end 167 of lever 168 which is pivoted upon a bracket 169 secured to the table or platform 5. The lever 168 is engaged at its rear end by a cam 170 upon cam-shaft 25.

The reciprocating plunger 164 carries the removable punch 171 secured in the usual manner by set screw 172, the punch 171 being presented in proper vertical alignment with the opening in the lower die plate 156. 173, shown particularly in Figures 18, (Sheet 9) and 28 and 29 (Sheet 11) of the drawings, is a gauge or pilot formed on its inner reduced end with prongs or fingers 174 which are adapted when pressed inwardly toward the metal strip-blank 43 to engage three successive recesses cut in the forward edge of the blank and by such engagement accurately position the blank for the final action of the punch 171. This gauge or pilot 173 operates upon the forwardly presented guide plate or table 175 which is recessed to fit over the forward shoulder of bed-block 148 to which it is secured by set screws 175a; said gauge 173 being presented in the forwardly open recess 176 of cover plate 157, and having a lower cutout portion 174a (Figure 29) fitting over the die plate 156. This pilot or gauge plate 173 is confined by means of guide plates 177 and is formed with a vertical rectangular slot 178 with which engages the lower shaped end 179 of the vertical lever 180 pivotally mounted at 181 upon a bracket 182 secured to the face of the upright head or standard 161. This lever 180 has pivoted to it a yoke 183 secured to the end of a rod 184 which passes through a suitable opening in head or standard 161 and supports a coil expansion spring 185 which is confined between the standard 161 and a nut 186 on rod 184. The action of this spring 185 upon lever 180 is to hold the pilot or gauge 173 in its forward or inactive position. The upper end of lever 180 is bevelled to engage a tappet 187 secured to the reciprocating plunger 164. It will be clear from this description that when the plunger 164 operates, the pilot or gauge 173 will first move into engagement with the recessed forward edge of the blank to accurately position it, and immediately thereafter the punch 171 will punch out the final part of the blank.

Connected view of actions of punches and dies of presses Nos. 1, 2, and 3 in forming metal closure members

The action of the several punches and dies carried by presses Nos 1, 2 and 3 will be best understood by reference to the detail enlarged views of Figures 19 to 27 on Sheet 10 of the drawings. Figures 19 and 20 show the action of the three punches 13, 14, and 15 of press No. 1. A plan view of the shapes of the die openings in die plates 80, 81 and 82 to receive punches 13, 14, and 15 is indicated in Figure 20. These three punches being mounted upon the common reciprocating plunger 12 will act simultaneously upon the metal strip-blank 43, but, because of their spaced relation, upon successive portions of the blank. Punch 13 forms perforations 43a, punch 14 forms recesses 43b and punch 15 cuts the notches 43c in the inner edge of blank 43 to open up the previously formed perforations 43a to form the oppositely presented prongs 43d which eventually are shaped into the final bifurcated hook of the fastening members.

Figures 21 to 25 illustrate the action of press No. 2. Press No. 2 carries two sets of shaping dies, one set comprising the lower female member 123 having spaced horns to project through two adjacent openings 43a of the blank, and an upper male die member 141 which is a simple scoring blade adapted to strike the blank between two perforations 43a and impart a transverse score or shallow cut 43e centrally between prongs 43d. This is for the purpose of assisting in shaping the final bifurcated hook and arched neck of the fastening member, the completion of this shaping operation being performed by the second set of dies 124 and 142. The lower female die member 124 has wings engaging the rear face of the blank adjacent to openings 43a upon opposite sides of a scored portion of the blank and a U-shaped head to receive the pronged head of the blank, the upper cooperating male die member 142 having a central rounded blade 142a designed to press the pronged head down into the recessed portion of the lower die member to properly curve the prongs 43d into the bifurcated hook and to shape the neck of the hook into the arched rounded neck portion. The blade portion 142a is preferably made as a removable section of the upper die member 142, it being inserted in a longitudinal slot or kerf in the end of the die member and removably secured therein by means of a pin or rivet 142b shown in Figure 25. After shaping the bifurcated hooks by press No. 2 the strip-blank or attached series of partly formed fastening members, passes to press No. 3 which carries a single punch 171 which intermittently acts to cut the dovetail recesses 43f in the forward edge of the blank between adjacent recesses 43b. Figure 27 shows a plan view of lower die openings to receive punch 171. This completes the shaping of the metal members with the exception of the riding lugs hereinafter referred to which are formed by cutting the remaining narrow strip of the blank between the formed heads and clamping jaws.

A continuous strip of connected properly shaped fastening members passes from press No. 3 through a longitudinal guide which supports the strip under the action of the buffing devices and auxiliary feed mechanism from the latter of which it is passed to the final press No. 4 by which the individual fastening-members are severed from the strip and delivered to the carrier which carries them away from the cut-off mechanism and supports them for mounting upon the flexible stringer or tape.

Buffing mechanism

This longitudinal guide leading from press No. 3 as just referred to, best shown in Figures 1, 2*a*, and 11, comprises a lower rigid bar **188** mounted upon the table **5** by means of supporting blocks **189** and formed in its upper face with a guide groove or channel **190** of approximate L-shape to receive the strip of connected formed fastener-members, and an upper covering plate **191** secured to the lower bar **188**.

This horizontal guide **188—191** is vertically recessed at **192** to receive the peripheries of two buffing wheels **193**, each of which is mounted upon a short shaft **194** freely journaled in the spaced bearings **195** of the H-shaped rocking frame **196** journalled at its lower end upon the pivots **197** and **198** carried by the bracket-frames **199** and **200** which depend from and are rigidly secured to the under face of the table or platform **5**. The bracket **200** is centrally located between the two brackets **199** and forms a common support for the adjacent arms of the two H-shaped rocking frames **196**. Each of the buffer carrying shafts **194** has secured to it between the bearings **195** a belt pulley **201**, over which runs a driven belt **202** passing from the driven pulley **203** carried by the main power shaft **204** which will be hereinafter more fully described. Each of the belts **202** is engaged by any suitable form of belt tightener such as indicated at **205**.

206 is a bracket secured to the table or platform **5** (in rear of the buffing wheels **193**) to which bracket is pivoted at **207** the upwardly extending rock-arm **208** supporting in its upper bifurcated end an anti-friction roller **209** that operates in peripheral engagement with a cam **210** upon the cam-shaft **25**. This rocker-arm **208** has adustable link connections **211** with the inner bearings **195** of both buffing wheels **193**. A coil spring **212** connects each of the H-shaped rocking frames **196** with the flange of the table or platform **5** for holding the buffing wheels **193** in their rearward position away from the metal strip-blank in its channelled guide and the anti-friction roller **209** in close contact with the actuating cam **210**. The high portion of the cam **210** moves the buffing wheels into engagement with the exposed parts of the formed strip of fastener-members while the strip is at rest and moves the buffing wheels away from the strip for each feeding stroke. The action of the buffing wheels may be maintained during a longer or shorter portion of the time of rest of the blank according to the buffing requirements.

Auxiliary feed

The work passes from the channelled guide bar **188** to an auxiliary feed device clearly shown in Figures 30, 31 (Sheets 11 and 12) and Figure 78 (Sheet 26), and comprising a reciprocatory slide plate **213** formed in its upper surface with the blank guiding channel **214**, and mounted to reciprocate in the channel **215** formed in the upper face of a flanged block **216** secured to the table or platform **5** by means of screw bolts **217**. The slide plate **213** is formed with laterally projecting wings **218** and **219** which rest in lateral projections **220** and **221** of the guide channel **215**, the slide plate **213** with its lateral projections **218** and **219** being of approximate Greek cross shape in plan, as clearly shown in Figure 78 of the drawings. Plates **222** and **223** are secured to the flanged block **216** by screws **224**, said plates overhanging the slide plate **213** for confining it upon the block **216**. The lateral wing **218** of the cross-shaped slide plate is formed in its upper face with a lateral guide groove or recess **225** in which operates a slide plate **226** formed on its inner end with three prongs or fingers **227** which are designed to engage three adjacent recesses in the forward edge of the metal strip-blank, or connected series of nearly complete fastener-members, and thereby clamp or grip the blank to the auxiliary feed slide. This slide plate or gripper **226** is formed with a vertical rectangular slot **228** in which engages the lower rounded end **229** of an operating lever **230** which is formed with an integral ear **231** operating in the bifurcated upper end **232** of the upright or standard **233** secured to the slide plate **213** by means of screw bolts **234**, a cover plate **235** being mounted upon slide **213** beneath the standard **233**, said cover plate extending over the guide channel **214**. The upper end of the operating lever **230** is slotted at **236** to receive the elongated roller **237** mounted upon pin **238** carried by bracket arm **239** which is mounted upon and vertically reciprocated by the plunger member of press No. 4 which will presently be described.

This auxiliary feed has an operating rod **240** adjustably connected at **241** with a lug **242** projecting from slide **213**. Said operating rod **240** extends to the right of the machine to a point in rear of reciprocating press No. 1 to which it attached as shown particularly in Figures 73 and 77 of Sheets 25 and 26 of the drawings. A block **243** is fitted upon and secured to the upright or standard **11** of press No. 1, bolts **243*a*** passing through the block into the standard. Bar **240** is bolted at **240*a*** to block **243**. By this means the auxiliary feed is operated by and simultaneously with the feeding motion of press No. 1 which has been already described. Immediately prior to the movement of the auxiliary feed through the connections referred to, the lever **230** is actuated to move the slide plate or gripper **226** into engagement with the metal strip-blank to feed the blank one step in the machine. The cooperation of the main feed of press No. 1 and the auxiliary feed which is coupled thereto results in uniform feeding of the blank and avoids all possible irregularities such as would sometimes be caused by burrs formed upon the blank by the punching operations.

Fastener-member cut-off press

The work next passes to press No. 4 which cuts the individual completely formed fastener-members from the continuous strip. This press No. 4 is particularly illustrated in Figures 7, 8, 9, 10 (Sheet 6), 31 (Sheet 12), 32, 33 (Sheet 13), 65 (Sheet 24) and 79 (Sheet 26) of the drawings. Press No. 4 is mounted upon a plate **244** secured to the table or platform 5 by means of screw bolts 246 inserted from beneath and extended up into the press base member 245. The upper face of base member 245 has mortised to it at 247, the upright head or standard 248, the two parts of the press being firmly secured together by screw bolts 249. Base member 245 has formed in it a longitudinal dovetail recess to receive the correspondingly dovetailed block 250, said block being secured in the desired adjusted position by means of screw bolts 252 and plates 253 and 254, said plate 253 carrying screw bolts 255 which engage the end of block 250. The plates 253 and 254 are secured to base member 245 by means of screws 256. It will be observed that the plate 254 extends only part way across one end of the base member 245 (see particularly Figure 33 of the drawings). The block 250 is formed with a central transverse groove or recess to receive a hardened metal plate 257 (shown in detail in Figure 10) which is secured in place by screw bolts 258 and 259. This hardened plate 257 has a central opening 260 to receive the tapered end of a pilot member presently to be described, said opening 260 registering with a central opening 261 formed through block 250. 262 is a cover plate secured to the face of block 250 by screw bolts 263. This cover plate 262 extends part way over the surface of block 250 and is formed in its under face with a guide groove or channel 264 for the passage of the work. An angular extension 265 of the cover plate is formed with a countersunk hole 266 presented above the work and registering vertically with the guide opening 260 of the hardened plate 257. This hole 266 is for the reception of the pilot member to be described. The cover plate is formed with a further extension in the form of a horn or arm 267 which projects parallel with the guide groove or channel 264 to confine the work against rearward displacement upon the extension 250a of block 250 during the cutting operation. This extension 250a is produced by cutting away the block 250 in the rear of delivery end of press No. 4, this cut-away being for the purpose of affording proper room for the operation of the fastener-member-carrier hereinafter described. The extreme edge of extension 250a is slightly undercut or inwardly bevelled from top to bottom as shown particularly in Figure 65, Sheet 24 of the drawings. The upper edge of this undercut wall is one of two slightly spaced parallel edges of the bottom or stationary member of the cut-off device. The cooperating parallel edge of the lower cut-off member is formed on a hardened metal plate 268 which is secured adjacent to the undercut face of extension 250a with a slight space at the upper or cutting edges of the two members, said space being maintained by means of a wedge shaped shim or spacing member 269; the plate 268 and shim member 269 being mounted upon parallel pins 250b projecting from extension 250a and securely held in position by a screw bolt 270, shown in Figure 65 being threaded through and supported by plate 254 with its inner end impinging upon or pushing against plate 268 and binding it in operative position. The spacing member 269 is somewhat narrower than extension 250a and plate 268 to provide a groove below the cutting edges of these members within which the cut-off knife of peculiar shape can operate. 271 is a curved leaf spring secured to cover plate 262 by screw 272, said spring curving around the guide hole 266 in which the pilot member operates and its free end being bent to engage the upper surface of the work parallel with the horn 267 and terminating close to the path of the cut-off knife. The work is further held at the moment a fastener-member is cut off by means of an overhanging finger 273 which has upon its under face a guide channel or groove in which projects the U-shaped clamping end of the tooth or fastening-member while it is being cut off from the strip. This overhanging guide finger 273 is integral with a supporting plate 274 which is secured by two screws 275 to the upper edge of plate 254 above referred to.

The movable cutting knife, shown clearly in Figures 8, 9, 32, and 33 comprises a cutting blade proper indicated at 276 mounted in the recess 277 of a supporting rock-arm 278 and firmly clamped therein by a screw bolt 279 engaging a similarly shaped filling plate 280. The knife carrying rock-arm 278 is journalled at 281 between the integrally connected face plates 282 formed as flanges projecting from a base plate 283. Base plate 283 is securely mounted in the upper face of block 250 alongside the cover plate 264 by means of screw bolts 284 and the bolt 259 above referred to which also extends through the hardened plate 257. The knife-supporting face plates 282 extend into the recess or cutout 285 formed partly in the base 245 and partly in the head or standard 248, see Figures 32 and 33. This mounting of the movable knife on its carrying frame presents a downwardly extending heel 276a which projects into the groove or channel between the cutting edges of the lower knife member comprising extension 250a and block 268. This heel 276a ensures the accurate registry of the blade 276 with the grooved lower cutting member. The knife carrying rock-arm 278 has a downwardly curved heel 278a with which engages the small plunger 286 which operates in a cylindrical cavity 287 in the base member 245 and supports a surrounding expansion spring 288 which is adjustably confined by a threaded tubular nut 289 screwed into the outer threaded end of the cylindrical cavity 287 into engagement with the plunger rod and spring and held in the desired adjusted position by the external lock nut 290 as shown in Fig. 8. The action of the spring plunger 286 upon the heel of the knife carrying rock frame is to yieldingly maintain the knife in elevated position above the path of the work.

The head or standard 248 supports a vertically reciprocating plunger 291 carrying at its upper end a sectional slotted yoke 292 engaged by an anti-friction roller 293 carried upon a pin 294 mounted in the bifurcated end 295 of operating lever 296 which is pivoted upon the bifurcated bracket 297 secured to the top of the table or platform 5 and is engaged at its rear end by a cam 298 on the main cam-shaft 25.

This vertically reciprocating plunger 291 (Figure 7) has the bracket arm 239 secured to it by means of a screw bolt 239a, said bracket having been heretofore referred to as the operating means for the lever 230 of the auxiliary feed mechanism. This reciprocating plunger 291 of press No. 4 has secured to its lower end a plate 299 secured by screws 300, see Figure 65, Sheet 24 of the drawings. This plate 299 is perforated at 301 to receive the stem of a tappet 302, the stem of said member having a driven fit with the perforation 301. The tappet member 302 is presented directly above knife-carrying rock-arm 278 so that upon the descent of plunger 291 tappet 302 will engage rock-arm 278 and cause the knife to operate. The raised position of the plunger and knife is shown in Figure 32 while the position immediately after cutting is illustrated in Figure 33.

A vertical cylindrical socket 303 extends up through plate 299 into plunger 291 and mounted in this socket is a tubular bushing 304 supporting a pilot member 305 which has a tapered active lower end 306 and a confining disk or head 307 at its upper end, an expansion spiral spring 308 being confined in socket 303 by the head 307, while the whole device is removably held in the socket of the plunger by means of a screw 309 which passes through the face of the plunger 291 and engages the tubular bushing 304. This pilot member 305 is supported directly above and in axial alignment with the opening 260 and hole 266 of the parts above referred to in which position it is ready upon the descent of the plunger to engage between the jaws of one of the forwardly presented U-shaped clamps of an attached fastening-member. This engagement of the pilot with a fastening-member while it is still part of the continuous strip of formed members will position the strip with great accuracy to place the final fastening-member in exact relation to the plane of cut-off for the action of the cutting-off devices.

The plunger 291 also carries a transverse plate or bar 310 slotted at 311 and secured to the plunger by set screw 312 passing through slot 311. This plate or bar 310 has a vertical cylindrical socket 313 adjacent its free end in which is mounted a spring plunger 314 having a stem 315 extending through the upper wall of the socket 313 and confined by a nut 316 threaded upon the stem, a spiral spring 317 being held between the plunger and the upper end of the cylindrical socket. This spring plunger 314 acting as a spring tappet is for the purpose of operating the gripper of the fastener-member-carrier which will presently be described.

Fastener-member-carrier

As each fastener-member is presented in position to be cut off as above explained, a carrier member is moved into position to grasp the projecting fastener-member and firmly support it while it is cut off, and then moved away with it to the next station. This carrier comprises a suitable track-bar supporting the carriage with a member gripper and proper control and operating devices which will now be described with particular reference to Figures 2*a* (Sheet 3), 6 (Sheet 5), 31 (Sheet 12), 32, 33, 34, 34*a*, 34*b*, (Sheet 13), 35, 36, and 37 (Sheet 14).

318 is a heavy plate or bar, in effect a track-bar which extends longitudinally of the machine and is rigidly mounted upon the table or platform 5 by means of screw bolts 319 passing up from beneath the table into the track-bar. This track-bar 318 also overlaps at one end the bed-plate 244 upon which press No. 4 is mounted, track-bar 318 being cut-out to fit over bed-plate 244 and being further secured in this position by machine screws 320 which are inserted from beneath the bed-plate 244, Figure 35. Track-bar 318 is formed with a deep longitudinal recess of dovetail cross-section to form trackway 321 for the reciprocating carriage 322 which has flared side edges to correspond with the shape of the trackway in the bar 318. A shim 323 is placed between one edge of the carriage 322 and the rear guidewall of trackway 321, said shim being engaged by screw bolts 324 to hold the parts in desired adjusted position.

The carriage 322 has secured to it at one end a transverse bar 325 secured by screw bolts 326 and with its rear end projecting beyond the carriage to form a stop at 327 which at the inner limit of the carriage stroke engages the head of a stop screw bolt 328 adjustably mounted in a lug 329 projecting upwardly from the rear portion of track-bar 318, Figure 31. A stop 330 in the form of a screw bolt is mounted in the end of carriage 322 in position to engage a similar screw bolt stop 331 which is adjustably threaded in a cross-bar 332 extending across and secured to the track-bar 318. The stop 330, 331 is the limit of the outward movement of the carrier.

Carriage 322 is formed with a transverse dovetail groove 333 in which is seated a block 334 having a base shaped to fit groove 333 and rigidly secured to the carriage by means of screw bolts indicated at 335. This block or auxiliary part of the carriage has a forwardly projecting integral shoulder 336 to which is secured a similarly shaped hardened metal plate 337 by means of machine screw 338. 336 and 337 are in the form of an anvil projecting forwardly from the carriage 322, 334, adjacent to its inner end, the extreme projection or nose 339 is formed with a shallow curved recess 340 ending at its inner edge in an abrupt curve said recess being an exact counterpart of the outer face of the rounded arched neck and bifurcated hook of the fastener, as shown in Figures 34*a* and 34*b*, Sheet 13 of the drawings. This grooved nose of the anvil just described constitutes the lower fixed member of a gripper which grips the yoke ends of individual fastener-members at the moment they are cut off and conveys them to the point where they are clamped to the tape or stringer.

The upper member or jaw of this gripper consists of a downwardly presented finger 341 having shallow grooves extending from front to back to form a central tip 342 shaped to engage the scored upwardly presented surface of the arched neck of the fastener-member that is clamped against the lower gripper nose 339. Upper gripper-member or finger 341 is also formed with a recess 343 to fit over the upwardly presented prongs of the bifurcated hook of the fastener-member when it is gripped. The gripper-finger 341 is formed upon a small base plate 344 which is secured by screws 345 to the forward edge of a gripper-carrying plate 346 which is mounted between two guiding upstanding plates 347 which are parts of the block 334 of the carriage. This gripper-carrying plate 346 is pivotally mounted upon a pin 348 extending through its rear lower corner and secured in the upstanding guide plates 347. A vertical cylindrical recess or pocket 349 receives a coil expansion spring 350 which rests at its lower end upon a shoulder 351 of the recessed block 334. This spring tends to normally hold the carrier gripper open, that is, with the upper gripper member 341 raised away from the lower gripper nose 339.

The pivoted gripper carrying plate 346 has an upwardly projecting lug 352 which is rearwardly bevelled at 353 and transversely grooved at 354 for the engagement of a locking lever 355 which is pivoted at 356 upon a pin passing through spaced guide flanges 357 which are integral with one of the plates 347. This locking lever 355 is formed with a rounded nose 358 designed to engage the shallow groove or recess 354 of gripper-carrying plate 346 to frictionally hold the same in open position, and, when the gripper is closed, to move into engagement with bevelled face 353 to lock the gripper in closed position upon a fastener-member. The face of the locking lever 355 which engages the bevel 353 of the gripper plate is also bevelled as indicated at 358 with the result that the coaction of the two bevelled faces 353 and 358 will exert a strong locking pressure upon the gripper jaws and said pressure being exerted by an arrangement of spring actuated levers presently to be explained will be a constantly exerted pressure to ensure a firm grip upon a fastener-member.

The locking lever 355 has a short longitudinal slot 360 with which engages a pin or lug 361 carried by a bell-crank lever 362 which is pivoted at 363 in a longitudinal channel 364 of carriage-block 322. Bell-crank lever 362 has an arm 365 by which the gripper-lock is released as hereinafter explained. The coil spring 366 seated in cylindrical cavity 367 in auxiliary block 334 engages the heel of lock lever 355 adjacent to its point of engagement with lateral lug 361. This spring 366 maintains the locking lever under spring pressure constantly to lock the gripper-carrying plate in either open or closed position.

The transverse bar 325 of the carriage 322 is notched at 368 to receive the end of a short link 369 which is pivotally anchored in notch 368 by means of a pivot pin 370. This link 369 is connected by a pivot bolt 371 to the lower end of a lever 372 pivotally mounted at its upper end 373 upon an upright bracket-arm 374 which is bolted rigidly to the track-bar 318. This lever 372 is formed with a longitudinal slot 375 in which is adjustably mounted a pivot bolt 376 carried by the long rod or bar 377 which extends over to the right hand end of the machine as shown in Figures 1 and 2 where its threaded end 378 is adjustably connected with a link 379 pivotally connected at 380 to the upper end of a rock-arm 381 projecting from an integral bearing hub 382 suitably journalled upon a bearing sleeve upon rock-shaft 28. The hub 382 carries a second integral rock-arm 383 carrying at its upper end an anti-friction roller 384 operating in a groove cam 385 carried by the main cam-shaft 25. By this last described mechanism the fastener-member carrier is intermittently reciprocated upon its track for taking a fastener-member from the cut-off position to the station where it is clamped upon the tape or stringer.

Operating between press No. 1 and press No. 2 is an intermittently operating brush 386 designed to brush off any chips or scraps that might possibly pass from the punch mechanism of press No. 1 and interfere with the accuracy of subsequent operations upon the metal strip-blank. This brush 386 is carried on an angular bracket-arm 387 pivoted at 388 to plate 389 secured to the rod or bar 377. 390 is a tray or chute suitably secured at 391 to tray flange 7 and extending beneath the work and brush 386 to collect any chips and convey them from the machine. See Figures 1 and 1a on Sheet 1 of the drawings.

Returning to the consideration of the control of the gripper of the fastener-member-carrier it will be observed that track-bar 318 is formed with a longitudinal slot 392 in which operates a controlling lever 393 mounted upon a rock-shaft 394 which is journalled in and extends rearwardly through a part of the track-bar 318. At the rear end of this rock-shaft 394 a rock-arm 395 projects upwardly and carries an anti-friction roller 396 which is presented in operative relation to cam-block 397 which is carried by the cam 288 on cam-shaft 25 as above described, see Figure 2a (Sheet 3) and Figure 81 (Sheet 26) of the drawings. A coil spring 398 connects the rock-arm 395 to the bracket-arm 399 projecting from one of the bearing brackets 28, said spring 398 yieldingly holding the arm 395 in the path of the cam-block 397 and the lever 393 in the bottom of the groove 392. Lever 393 carries adjacent to its free end an adjustable stop 400 in the form of a screw bolt which engages the bottom of the groove, and also a second adjustable stop bolt 401 presented upwardly in position to engage the arm 365 of bell-crank lever 362. It will be observed that bell-crank lever 362 is arranged in the same vertical plane as the tripping lever 393 and that when the carriage is moved to its extreme left in position to present a fastener member to the tape or stringer, the arm 365 of bell-crank lever 362 will at that time be presented directly above adjustable stop 401 of the trip-lever 393, as shown in Figure 36, (Sheet 14) of the drawings. In this position, with proper relation to the tape or stringer mechanism and the fastener-member clamping devices, the cam-block 397 acts to raise trip lever 393 to open the member carrying gripper and release the member as it is fastened to the tape or stringer.

Stringer forming mechanism

Mechanism for folding a tape into a two-ply stringer having a four-ply thickened or beaded edge, (said closure stringer being covered by Patent No. 1,585,654 dated May 25, 1926), is arranged at the delivery end of the machine in front of and opposite the delivery position of the fastener-member-carrier. This mechanism will now be described with particular reference to Figures 6 (Sheet 5), 7 (Sheet 6), 38 (Sheet 15), 39, 39a, 39b, 39c, 40, 41, 42 (Sheet 16), 43, 44, 45, 46, 47, 48 (Sheet 17), 56 (Sheet 20) and 80 (Sheet 26).

The table or platform 5 is cut out at 402 to form a well in front of the track-bar 318 of the fastener-member-carrier. A heavy horizontal bed-plate 403 is rigidly secured by screw bolts 403a to the table or platform 5 in front of the cut-out well or opening 402. This bed-plate 403 is provided with flanges having under cut surfaces 404 constituting a guide track for the horizontal base portion 405 of a reciprocatory frame which carries the tape-forming, feeding and other associated mechanisms. This portion 405 of said frame is dovetail in cross section to operate within the guide surfaces 404, a shim or wearplate 406 being adjustably held between one of the guide surfaces 404 and the member 405 by means of screw bolts 407, Figure 56. This horizontal or base portion 405 of the frame has secured to it two rack bars 408 which are in constant mesh with gear wheels 409 fixed upon a shaft 410 journalled in the side brackets 411 attached to the bed-plate 403. The bracket 411 at one side is integral with a plate which extends rearwardly upon bed-plate 403 and terminates in the spaced guide arms 411a which embrace one of the oppositely projecting horizontal guideway members 484 hereinafter referred to. The shaft 410 is extended beyond the bearing at one end to receive a rock-arm 412 which is fixed to the shaft and is longitudinally slotted at 413 to receive the adjustable pivot bolt 414 carried in the forward end of a rod or pitman 415 extending rearwardly and pivotally connected at 416 to the upper end of a rock-arm 417 formed integrally with a hub 418 freely journalled upon a short shaft 419 carried in the brackets 420 secured to the table or platform 5. This hub member 418 also has formed integral with it a rearwardly projecting rock-arm 421 carrying in its end an anti-friction roller 422 operating in the box cam 423 carried by the main cam-shaft 25. This described mechanism causes the base frame 405 supporting the tape-folding and associated devices to be intermittently moved inwardly and outwardly toward and away from the fastener-member-carrier.

The bed-plate 403 has secured to its forward end a stop bar 403*b* which is centrally perforated for the free passage of a screw stop bolt 405*a* which projects forwardly from the reciprocatory frame base 405 and carries the adjustable stop and lock nuts 405*b*. By these means the reciprocations of the frame carrying the tape folding and associated devices can be adjusted.

The horizontal base portion 405 of the described frame has formed integral with it the upright side frames or standards 424 united by a heavy back web or plate 425, parts 405, 424, and 425 constituting a rigidly braced heavy frame for supporting the mechanisms which will now be described, see Figures 6, 39, and 56 of the drawings. This frame reciprocates upon the bed 403 above referred to.

As hereinafter more fully pointed out, the reriprocatory frame 405, 424, 425, has rigidly secured to it the oppositely projecting guideway members 484, which, in addition to their functions later to be pointed out, serve the important purpose of supporting said reciprocatory frame at its rear or inner corners. The guide member 484 nearest to press No. 4 slides in the guide fingers 411*a* of the supporting bed 403, while the opposite guide member 484 is embraced by the heavy guide yoke 403*x* projecting from the supporting block 403*y* rigidly bolted to the table or platform 5 at the end of cut-out 402.

Mounted upon one of the standards 424 is an upright arm 426 supporting in its upper end a bolt 427 on which is journalled a spool or reel 428 upon which is wound a supply of suitable tape or webbing 429 from which the stringers or carriers of the flexible closures are made. The spool or reel 428 is engaged by a brake member 430 pressed against the spool or reel by spiral springs 431 confined upon the bolt 427.

The web or plate 425 is cut away or slotted at 425*a* and mounted upon the plate 425, beneath the slot 425*a* is a bracket plate 432 carrying a metal block 433 which is suitably shaped and cut away to receive the operating parts now to be described. Block 433 is surmounted by a vertically projecting U-shaped tape former 434 having perforated ears 435 through which attaching screws 436 pass to secure it in position on top of the block 433. This tape former leads to a vertical channel or opening 433*a* extending through the block 433. Cooperating with the U-shaped former 434 is a blade 437 which fits within the U-shaped member 434 and is of sufficiently reduced dimensions to provide a U-shaped guideway between members 434 and 437 through which the tape or web 429 is drawn and by which the tape is gradually formed into a two-ply stringer or carrier. This blade member 437 is pivotally mounted at 438 in the open throat of former 434 and is held in upright spaced relation to the U-shaped former by means of thumb screw the walls of members 434 and 437. By removing the thumb screw 439 the blade 437 can be moved outwardly on its pivot 438 into position to facilitate the ready insertion of the tape or web through the former 434.

Immediately below the lower end of the tape-forming blade 437 the once folded tape is engaged by cooperating male and female bead forming rollers, see Figure 39, Sheet 16 of the drawings. A pair of relatively small peripherally grooved rollers 440 and 441 are freely journalled in a forked triangular carrying frame 442 which is presented in tape-guiding channel 433*a* above referred to; said frame 442 being pivoted at 443 upon the inwardly presented ears or lugs 444 of a floating plate 445 which has secured to its outer face a U-shaped bracket 446 to which is pivoted at 447, a cam lever 448 having a heel 449. Rods or bolts 450 anchored in the block 433 project through openings in the ends of plate 445 which guides thereon, said rods supporting coil springs 451 confined by adjustable thumb nuts 452 threaded upon the rods or bolts. The plate 445 rests upon the edge of plate 453 which is secured to an inclined face or surface of block 433 adjacent to channel 433*a*. The heel 449 of the cam lever 448 is designed to engage an inclined wearplate 453 and by its action move the plate 445 carrying member 442 and rollers 440 and 441 outwardly away from the opposite cooperating fixed roller 454 journalled at 455 in a slot or recess formed in the block 433. The frame 442 carrying the peripherally grooved rollers 440 and 441 presents these rollers on the inside of the fold of the tape or web as it passes below the former 434, 437. The roller 454 has a sharp convex periphery which engages the outer face of an apex of the fold of the tape or web just opposite the first roller 440 and reverses the crown of the fold into the V-shaped periphery of roller 440 having the effect of producing a double or M-shaped fold, which is continued and creased in this form by the cooperation of the lower roller 441.

Immediately below the folding rollers 440, 441, and 454 the once folded tape, having the thickened or twice folded beaded edge, passes into the grip or bite of two oppositely arranged cooperating pressure rollers 456, each of which is freely journalled between the ears 457 of a sliding block 458 operating in a transverse channel 459 of block 460 which is secured beneath the block 433 by means of screw bolts 461. This block 460 has a guide slot 460*a* extending through it and forming an extension of the guideway 433*a* of block 433, the rollers 456 being arranged to engage the folded and beaded tape or web in line with said guideway. The outer ends of block 458 are recessed at 462 to fit over and guide upon plates 463 which are secured to blocks 433 and 460 and extend across the channel 458. A centrally perforated plate 464 is secured to the outer end of block 458 outside of the guide plate 463, a guide rod 465 being seated in the plate 463 and extended through the central opening of plate 464 and supporting the coil spring 466 which is engaged by a thumb nut 467 threaded on the outer end of guide rod 465. This arrangement is duplicated on both sides of the channel or passageway for the folded tape or web, the springs 466 pressing the rollers 456 tightly together upon the folded tape or web and effectively compressing the four-ply twice folded beaded

The roller carrying blocks 458 are also formed with transverse grooves 468 in their upper faces. In the vertical plane of these grooves 468, the block 433 is provided with cylindrical sockets 469 in which are journalled the cylindrical heads 470 having upon their outer ends the operating levers 471 and upon their inner ends the eccentric lugs or pins 472 which engage in the transverse grooves 468 of blocks 458. These heads 470 are formed with annular grooves 473 in which engage the reduced inner ends of screw bolts 474 threaded in suitable openings in the block 433. These screw bolts 474 lock the rotary heads 470 in place while permitting them to rotate. It will be understood that by actuating the hand levers 471 the blocks 458 can be moved outwardly to separate the rollers 456. A half revolution of the heads 470 will place the eccentric lugs or pins 472 in position to hold the rollers in separated released position against the action of their springs.

475 and 476 are cooperating downwardly extending tape-guiding plates formed with ribbed inner faces to prevent backward movement of the folded tape. In addition to the transverse ribs or downwardly inclining teeth, plates 475 and 476 are vertically grooved or channelled on their inner faces adjacent the front edge to accommodate the four-ply beaded or thickened edge of the folded tape or web as shown in Figures 40 and 42. These plates 475 and 476 are formed integral with horizontal slotted ears 477 through which extend machine screws 478 which are threaded into the bottom of block 460. These plates 475 and 476 are slidably mounted in the manner described and are engaged by pressure springs 479 encircling screw rods 480 mounted in the plates 475 and 476 and passing freely through flanges 481 of bracket members 482 secured to the bottom of block 460 and assisting in guiding the ears 477 of plates 475 and 476. The screw rods 480 are engaged outside of flanges 481 by threaded nuts which can be adjusted to limit the approach of plates 475 and 476 together upon the folded tape or web and therefore limit the pressure of said plates upon the tape or web.

The lower ends of plates 475 and 476 are cut back or reduced in thickness as shown at 483 in Figure 38 of the drawings to receive the ends of the plungers carrying the clenching devices which compress the yokes of the fastener-members upon the beaded or thickened edge of the tape or web.

Mechanism for mounting fastener-members upon the beaded folded tapes or stringers

Upon each side of the path of the folded tape or web is mounted a horizontal guideway member 484 in which operates a reciprocating plunger 485, engaged at the rear by coil spring 486 confined by a plate 487 secured to the guideway 484. Each of the plungers 485 is formed on its inner end with three spaced lugs 488, the two plungers being designed to fit over and engage the yoke ends of attached spaced fastening-members.

Each plunger 485 also carries an inner auxiliary plunger indicated at 489 which carries at its inner end a clenching blade or tool 490. This auxiliary plunger 489 carrying the clenching tool 490, operates in a guideway 491 of the main plunger body 485 and upon the opposite side of the plunger 485 is a corresponding slot or guideway 492 in which operates a guide block 493 connected with the auxiliary plunger 489 by means of a screw bolt 494 which supports between auxiliary plunger 489 and guide block 493 an anti-friction roller 495, see Figures 52 and 53, Sheet 19 of the drawings. This roller 495 is presented in the same vertical plane as the central longitudinal guideway or slot 496 of the main plunger 485.

The rear end of each plunger 485 is covered by a rectangular plate 497 secured by means of a screw bolt 498 passing through the plate 497 and an integral web portion of the plunger 485, the bolt being secured by a nut 499 on its inner end. This plate 497 affords a proper seat for the engagement of spring 486 above referred to.

The opposite guideways 484 are rigidly secured to the back face of the vertical web or plate 425 by means of screw bolts 500. Centrally between these bolts 500 is a headed bolt 501 threaded through the web 425 and secured by a nut 502, this bolt 501 being supported with its head in rear of the lower cut away portions of the tape engaging plates 475 and 476 and acting as an anvil or back support for said plates during the operation of clenching fastener-members upon the exposed beaded or thickened edge of the folded tape or web. 503 are face plates secured to the guide blocks 484 and holding in place therein the plungers 485.

Cam-bars 504 extend vertically through the guide slots 496 of plungers 485 and through the vertical guideways 505 of guides 484, said cam-bars 504 being formed near their upper ends with cam-slots 506 which embrace and operate upon the anti-friction rollers 495 of auxiliary plungers 489, for actuating the main plungers 485 and auxiliary plungers 489.

The guideway members 484 are rigidly mounted upon the base of the web or plate 425 between two bars 507 and 508 set in grooves in the plate 425 and secured by means of machine screws 509.

The lower ends of the tape-guiding members 475, 476 are of the same depth from front to rear as the main portion of these guides, the longitudinal cut-out at 510 being deeper to receive the fastener-members which are clamped upon the beaded edge of the tape or web within the cut-out portion of said guides 475, 476.

Arranged below the lower ends of members 475, 476 are two closely aligned guide plates 511 formed with deep longitudinal guide grooves 512 in which the prongs of the fastener-members project and thin spaced flanges 513 which engage the narrow neck portions of the fastener-member as the fastener-members clamped upon the folded tape or stringer pass downwardly. These guide plates 511 are supported at their upper ends upon the lower ends of members 475 and 476 by means of machine screws 514 and are connected at their lower ends by a bridge plate 515 which maintains them in proper parallel relation. A U-shaped plate 516 is connected to the inner ends of guideways 484 and overlaps the face plates 503 and the connecting overlapping upper ends of guide plates 511, said plate 516 thereby firmly connecting and bracing these parts of the structure.

Tape-feeding mechanism

The tape or web is drawn through the folding and fastener-member applying devices by a step-by-step feeding mechanism which engages the folded beaded tape immediately below the point of application of the fastener-members and directly in rear of the guide plates 511 which engage and guide the series of fastening-members that have been clamped upon the beaded edge of the folded tape. This feeding mechanism includes cooperating gripper-members operated by the vertically reciprocating cam-bars 504 above referred to.

The cooperating gripper bars are clearly shown at 516a in Figures 38 (Sheet 15), 39, 39a, 41 (Sheet 16), 49, 50 (Sheet 18), 51 (Sheet 19), and 54 (Sheet 20) of the drawings. Each gripper-member 516a is formed with an inner transversely grooved gripper face 517 and a vertical recess or cut-out 518 to accommodate the fastener-members upon the beaded edge of the tape. The longitudinal slots 519 in bars 516a permit the passage of the cam-bars 504, each of said slots housing an anti-friction roller 520 freely journalled upon a transverse bolt or pin 521 and said anti-friction roller 520 being also seated in a cam slot 522 of a cam-bar 504. A stud 523 projects from the outer end of each gripper bar 516a in engagement with the slotted upper end 524 of a lever 525 which is formed with an inwardly turned fulcrum nose 526 resting in engagement with the block 527. There are two of these levers 525, one on each side of the gripper mechanism and they are connected by a heavy coil contractile spring 528 acting through headed rods 529 passing through openings in levers 525 and one of said rods being provided with screw nuts 530a engaging the threaded ends of said rod whereby the tension of spring 528 can be adjusted.

Each of the cam-bars 504 is enclosed for a part of its length including the slot 519 by a bearing block 530 shown particularly in Figures 38, 39, 41, and 55. The bearing block 530 is confined upon the cam-bar 504 by means of plates 531 secured to the opposite faces of bearing block 530 by means of machine screws 532 and having integral inturned flanges 533 which extend over the upper corners of one of the gripper bars 516a and confine said gripper bar upon the upper edges of bearing block 530. From this construction it will be understood that the cam-bar 504 will slide freely through the bearing block 530 within the limits of the engagement of the ends of slot 522 with the anti-friction roller 520, the gripper bar 516a moving transversely with reference to cam-bar 504 when this relative movement takes place. The two bearings blocks 530 are connected in proper spaced relation by means of a bridging bracket 534 secured by means of screw bolts 535. These bearing blocks 530 are shaped on the outer vertical edges to fit groove trackways 536 formed on the inner faces of plates 527 rigidly secured to the depending side flanges 538 of the movable frame of tape former. A stop plate 539 is secured to the plate 527 and formed with a forwardly presented recessed end having spaced stop lugs 540 between which operates a stop lug 541 carried by bracket 542 secured to the bridge piece 534 above referred to, see Figures 6 and 7 of the drawings. The lower stop lug 540 at each side has threaded through it an adjustable stop screw 543 for determining the lower limit of the movement of bridging piece 534 and the parts connected therewith.

544 is a block rigidly mounted in the recessed face of plate 527. This block 544 has pivotally mounted at 545 a latching dog 546 having a laterally presented notch 547 at its upper end engaged by a leaf spring 548 secure to the block 544; said block 544 also carries a keeper dog 548 pivoted at 550 opposite the latching dog 546, and engaged by a leaf spring 551 attached to block to receive dogs 546 and 549 and to permit them to operate. Each of the gripper bars 516a is provided on its upper face near its outer end with a rigidly attached strip 552 which projects toward the rear to form a stud designed to be engaged by the latching dog 546 and the keeper dog 549. It will be understood that a latching device such as described is provided at each side, one for each of the gripper bars 516a. The purpose of these latching devices is to hold the gripper bars against vertical displacement while the cam-bars 504 are moving vertically through the gripper bars so as to ensure the movement of the gripper bars either inwardly into gripping position with the folded tape or outwardly to release their grip upon the tape, it being essential in initiating either of these movements that the engagement or disengagement of the grippers must be effected before the grippers are moved vertically.

The lower end of each cam-bar 504 has attached to it a connecting yoke 553 which is pivotally connected at 554 with a pitman 555 adjustably connected at its lower end with a yoke 556 journalled upon the reduced end 557 of a short axle 558 which is carried in the notch or recess 559 adjacent to the upper end of a vertically sliding bar 560. A thumb screw 561 is threaded through the bar 560 into the axle 558 for retaining it rigidly in place. The open end of recess 559 is normally closed by a spring pressed gate 562. In this way the axle 558 is rigidly mounted upon the bar 560. There are two pitmen 555, one projecting downwardly from each of the cam-bars 504 and these pitmen are journalled upon the opposite reduced ends of the short axle 558. The bar 560 reciprocates freely in the vertical guideway 563 of arm 564 having a hub 565 which is rigidly mounted upon a fixed shaft-like support 566 mounted horizontally in the bracket-bearings 567 and 568. Freely journalled upon the dead shaft 566 adjacent to the guide arm 564 is a rotary tubular shaft 569 upon which is secured box cam 570 engaging an anti-friction roller 571 journalled on stud 572 projecting from the face of the vertically reciprocating bar 560. Rotary tubular shaft 569 also carries a driving sprocket wheel 573 over which operates a sprocket chain 574 extending from and driven by a sprocket 575 fixed to the inner face of a large gear wheel 576 which is freely journalled upon the end of the main cam-shaft 25 alongside of one of the bearings 26. This large gear wheel 576 carries one of a pair of clutch members for locking the gear to the cam-shaft when it is desired to rotate the cam-shaft; said gear 575 being, however, normally free to rotate on the cam-shaft and form an element of the drive from the power shaft to the feed mechanism for the tape-folding and feeding and associated devices. This large gear 576 meshes with and is driven by a smaller gear 577 freely journalled upon a stub shaft 578 secured to the machine frame by the bracket plate 579 and braced at its outer end by the bracket 580. The small gear 577 is firmly secured to and rotates with a large combined fly-wheel and driving sprocket 581, also journalled upon stub shaft 578, which in the form shown has a circle of sprocket teeth set centrally in its periphery over which operates a sprocket chain 582 which operates around and is driven by a sprocket wheel 583 mounted upon a shaft 584 suitably journalled in bracket-bearings 585 and 586. This shaft 584 carries at its inner end a gear wheel 587 meshing with and driven by a smaller gear wheel 588 keyed to the

Operation of cam-bars upon the fastener-mounting plungers and the tape-feed grippers

A comparison of Figures 38, 49, 50, and 51, illustrating the slotted cam-bars and mechanism actuated by them in various positions, will lead to a clear understanding of this part of the machine.

It will be observed from the illustrations in the figures of the drawings mentioned, that the cam slots 508 which operate the fastener-member applying plungers are so arranged in the cam-bars 504 that the upward movement of the cam-bars causes the plungers 485 and 489 to move inwardly for performing their functions and the downward movement of the cam-bars withdraws these plungers into their inactive position. The cam slots 522, lower down upon the cam-bars 504, are arranged in exactly the reverse positions so that the initial upward movement of the cam-bars moves the gripper bars 516*a* outwardly into released position to permit the raising of the gripper bars upon the tapes or stringers for a new grip, while the initial downward movement of the cam-bars moves the gripper bars inwardly to grip the folded tape or stringer preparatory to feeding it a step downwardly.

In Figure 49 the cam-bars 504 are shown on their upward move, the feed gripping bars 516*a* having been drawn apart to release the tape and the fastener-member mounting plungers 485, 489 being partly moved inwardly, the reciprocating frame which supports the tape folding and associated members being at the moment moving toward its inner position to place the beaded edge of the folded tape in the open jaws of the fastener-member that is held by the carrier gripper 339, 341 to receive the tape, as shown in Figure 52, Sheet 19 of the drawings. In Figure 50 the upward movement of the cam-bars is being completed, the fastener-member being in the act of being clenched by the plungers 489. The completion of the clenching operation upon a fastener-member is shown in Figure 53, Sheet 19 of the drawings. It will be noted that in Figure 49 the projecting ends of the strips 552 of gripper bars 516*a* have moved out of engagement with the latching dogs 546 and have pressed back the keeper dogs 549 so that the gripper bars 516*a* can move upwardly with cam-bars 504 as they have started to do in the position shown in Figure 50. In Figure 51 the cam-bars 504 have started to move downwardly, the fastener-member applying plungers 485, 489 having been partly withdrawn and moved outwardly, while the gripper bars 516*a* have started to move inwardly to grip the folded tape. In Figure 38 the change of position of the parts is shown complete in that the plungers 485, 489 are completely moved outwardly and the gripper bars 516*a* are in their inner position gripped upon the tape and latched to the carrier frame in which the cam-bars are mounted by reason of the strip members 552 having moved into engagement with the latching dogs 546. In this position the cam-bars 504 are moved down to a complete feeding stroke, the grippers 516*a* carrying the folded beaded tape with an applied fastener-member one step downwardly to present a new beaded section of the tape in the proper horizontal plane for receiving the next succeeding fastener-member. As this tape feeding operation is completed the frame or carriage which supports the tape mechanism and associated devices is moved forwardly away from the path of the fastener-member-carrier which is immediately afterward returned to the member cutting-off position for gripping another fastener-member.

Stringer cut-off mechanism

The tape or stringer with fastening-members clamped to its beaded or thickened edge passes from the intermittent feed mechanism into a rectangular funnel shaped guide 589, the throat of which is contracted into a rectangular guide tube 590 which terminates just above a pair of cut-off shears which will now be described with particular reference to Figures 6 and 7 (Sheets 5 and 6 respectively), and 57 and 58 (Sheet 21) of the drawings. The shears proper comprise two cutter-blades 591, 592 pivotally mounted upon a bolt 593 which extends downwardly through a bracket plate 594 which is supported upon a machine end frame beneath the table 5. A spacing collar 595 is mounted upon the bolt 593 between the bracket plate 594 and the cutter blades 591 and 592, the blades being supported thereon by means of a nut 596 threaded upon the reduced end of bolt 593. The headed end of bolt 593 confines a coil expansion spring 597 against bracket 594 for yieldingly pressing cutter blades 591 and 592 together. The guide funnel 589 with tubular extension 590 is supported by bracket plate 598 secured to the plate 594 by set screw 599. The cutter blades 591 and 592 have outwardly extending bell-crank arm 600 to which are pivotally connected the links 601 in turn pivoted at 602 to the yoke 603 mounted upon a reduced end 604 of a solenoid core or bar 605, said reduced end having sliding bearing in a bushing 606 carried by bearing block 607 depending from the bracket plate 594. A spiral expansion spring 608 also surrounds the reduced portion 604 of the core or bar 605 and is confined thereon against the bearing block 607 by means of a head or disk 609 secured to the end of bar 604. This disk or head 609 engages the rounded heels 610 of the cutters 591, 592. A cushioning washer 611 is mounted upon reduced end 604 between yoke 603 and bearing block 607. A solenoid magnet 612 is mounted in a suitable frame 613 of which bracket arms 614 are secured to the under surface of plate 594. This magnet 612 has a central cylindrical chamber 615 in which is mounted a fixed core 616 toward and away from which reciprocates the movable core 605. The fixed core 616 serves as a stop for the inward movement of the movable core 605 when it performs the cutting operation. The circuit through solenoid 612 is controlled through the terminals 617 (shown in Figure 83, Sheet 27 of the drawings), by the automatic initiative control mechanism hereinafter described, it being understood that in the operation of the machine it is intended to feed the folded beaded tape for a required length and apply a predetermined number of fastener-members thereon and follow these measured operations by the action of the cut-off shears which sever the completed stringers in the desired lengths. As the lengths of stringers are severed by the shears they drop into an inclined chute 618 mounted upon the bracket-arm 619 and extended to one side to deliver the completed stringers into a convenient receptacle.

Cam-shaft driving mechanism

Referring to Figures 3 and 4 (Sheet 4) and 68, 69, and 70 (Sheet 24) of the drawings, it will be observed that the gear 576 is formed in its outer face with a shallow cylindrical recess 620 in which is seated a hardened metal disk 621 secured by screws 622, said disk being formed with an axial opening 623 in which engages the heavy dog 624 secured by screws 625 to a collar 626 which slides upon a squared portion 627 of the cam-shaft 25. When collar 626 is in its inner position against disk 621 as shown in Figures 4 (Sheet 4) and 68, (Sheet 24) of the drawings, the gear 576 is clutched upon the cam-shaft for driving it. The outer end of cam-shaft 25 carries a stout coil-spring 628 confined against the collar 626 by the collar 629 fastened to the shaft by screw 630. The action of the spring 628 is to move the dog 624 into clutching engagement and hold it in this operative position until it is positively disengaged by the clutch controlling devices which will now be described.

Pivotally mounted at 631 upon a part of the bracket plate 580 is a clutch controlling lever 632 having a bevelled blade 633 which when moved inwardly toward the shaft 25 will be presented in the path of the inclined cam face 634 formed in the dog supporting collar 626. When lever 632 engages collar 626 while the shaft 25 and gear 576 are rotating in clutched condition, the collar 626 will be forced outwardly against the action of spring 628 and thereby release the cam-shaft while the gear 576 continues to rotate.

The clutch operating lever 632 is formed with a bell-crank arm 635 to which is pivoted at 636 a link 637 pivoted at 638 to a head 639 secured to the upper end of a vertically movable controlling rod 640 which extends downwardly and terminates as a movable core in a solenoid magnet 641 mounted in the frame 642 suitably secured to bracket plate 643 extending from the base frame of the machine. This controlling rod 640 passes through a perforated bracket arm 644 projecting from and secured to the bracket 580 of the machine frame. An expansion coil spring 645 is confined upon rod 640 between the bracket 644 and the head 639 to give a spring tendency to throw the clutch controlling lever 632 upwardly and hold it in that position with the clutch disengaged. This rod 640 is moved downwardly against the action of spring 645 when it is desired to cause the clutch dog 624 to move inwardly into clutched position.

The rod 640 can be moved either automatically by an electric control acting through the solenoid 641 (see control circuit Figure 83, Sheet 27 of the drawings), in the manner that will be hereinafter explained, or mechanically through the hand operated lever 646, secured to a rod or shaft 647 which is journalled in the machine frame and carries upon its outer end a rock-arm 648 having a loose joint pivotal connection 649 at its end with a block 650 adjustably secured to the rod 640. By moving the hand lever 646 rod 640 can be pulled downwardly to permit the clutch 623, 624 to move into action for causing the rotation of the cam-shaft 25.

In the electrical automatic operation of the clutch (see Figures 3 and 4, Sheet 4, and Figure 83, Sheet 27 of the drawings), an auxiliary electromagnet 651 mounted upon a bracket plate 652 extending from the solenoid frame 642 acts upon a keeper plate 653 of a hook lever 654 pivoted in the bracket 655 in position to normally engage a tappet block 656 which is adjustably mounted upon the controlling rod 640. The face of tappet block presented toward the hook lever 654 is bevelled slightly to freely pass the hook end of the lever when it is moved downwardly from its upper position. In this construction it will be understood that when an electric impulse is passed through the solenoid magnet 641 through the automatic initiative control hereinafter explained, the rod 640 will be drawn downwardly, permitting the clutch on the cam-shaft to move into clutched position, and the tappet 656 will move down past the hook lever 654 and be engaged thereby to latch the clutch controlling rod 640 in its lower position. It should be mentioned that the hook lever 654 is provided with a heel 654*a* carrying a leaf spring 654*b* which engages the bracket plate 652 to give the lever 654 a spring tendency away from the magnet 651 toward the tappet block 656 with which it latches.

The machine is preferably driven by an electric motor indicated at 657 firmly secured to the base of the machine frame, see Figures 1 and 83 (Sheets 1 and 27 respectively) of the drawings. The motor-shaft 658 is aligned with the main power shaft 204 above referred to, the adjacent ends of these shafts carrying the driving and driven clutch members 659, 660 of any approved construction. The details of this main clutch are not illustrated in the drawings, but a sliding clutch actuating collar 661 is shown upon shaft 204 connected through arm 662 with the driven or movable clutch member 660. Collar 661 is operated by rock-arm 663 extending up from the rock-shaft 664 journalled in bearing brackets 665 and carrying at its opposite end a long manually operated clutch-operating lever 666 which is placed in convenient position for the operator.

Automatic initiative controlling mechanism

In addition to the electromagnetic operation of the cut-off shears and the clutch of the cam-shaft through electromagnets 612, 641, and 651, there is an electrically operated counter mechanism 726, Figure 83 (Sheet 27) of the drawings, which determines the number of completed articles produced by the machine and, upon the arrival of the predetermined quantity, shuts off the operation of the machine preferably by throwing out the main circuit switch. This counter mechanism may be of any approved form, but is preferably of the construction set forth in Patent No. 1,685,481 dated September 25, 1928. The operation of this counter-mechanism is by electrical impulses, imparted through a suitable current reducing relay initiated by one of a plurality of controlling switches which are automatically actuated by the operation of the machine.

Mounted on the bracket 667 secured to the upright angle bar 668 of the machine frame is an insulated plate 669 formed in its inner face with a shallow longitudinal groove or channel 670. Embedded in the bottom of this channel 670 are four contact members 671, 672, 673, and 674, (or more if desired for additional controls) which are connected respectively through suitable insulated wires and current reducing relays 671*a*, 672*a*, 673*a*, 674*a* with the clutch-solenoid 641, clutch electromagnet 651, the shear solenoid 612 and the operating magnet 727 of the mechanical counter 726, see Figure 83, Sheet 27 of the drawings. Hinged at 675 to the insulated plate 669 is an insulated cover plate 676 carrying on its outer face the bracket 677 in which is mounted a pivot shaft 878 supporting the spaced electrically connected contact levers 679 which are formed with inwardly presented noses 680 which project through elongated slots 681 in vertical alignment respectively with the several contacts

671 to 674. Leaf springs 882 are secured to the block 676 and engage the heels of contact levers 679, one spring being for each lever. A latch 676a pivoted upon upright 868 engages cover plate 676 and holds it closed. When it is desired to swing the plate 876 into open position, latch 876a is moved back against stop screw 876b, see Figures 1 (Sheet 1) and 60 (Sheet 22) of the drawings. The circuit wire 683 connects with one of the levers 679 and through the supporting pivot 678 electrically connects the whole series of contact levers, with the four relays 871a, 672a, 673a and 674a, as shown in Figure 83, Sheet 27 of the drawings.

The circuit wires from the several contacts 671 to 874 and from the contact levers 679 are formed into a cable indicated at 684 which passes to a convenient part of the machine frame where it enters a box 685 designed to support the proper relays of well-known construction from which wires lead through the several controlling magnets above referred to.

Passing down through the shallow channel 670 of the insulated plate 669 and beneath cover plate 678 is an endless band 686 of suitable insulating material which normally separates the noses of levers 679 from the contacts 671 and 674. This band 686 may conveniently assume the form of a ribbon or web of fireproof and insulating material such as used for a film in a moving picture machine in which case the band has a series of accurately spaced sprocket perforations 687 operating over the sprocket pins 688 of the spools 689 freely journalled upon pins 690, one spool 689 being mounted above and another spool 689 being mounted below the insulated plate 669 and 676 between which the controlling film 686 passes. The band 686 being endless passes from the lower spool 689 up over a guide spool 691 journalled on a pin 692 which is adjustably mounted in the vertical slot 693 of the upright angle bar 668, said journal pin being secured in the desired adjusted position by means of a thumb nut 694 threaded upon the inner end of pin 692. The endless band 686 passes from the spool 691 down around the first named sprocket spool 689, the band being also engaged, between spools 691 and 689, by a flanged tightener spool 695 mounted upon a pin 696 carried in the end of an arm 697 pivoted at 698 in the upright angle bar 668 and formed with a transverse slot 699 which receives a bolt 700 upon which is threaded a thumb nut 701,—the bolt passing through an opening in upright 668 and the slot in the tightener arm 697.

This endless controlling band 686 is formed at proper predetermined intervals with slits or openings indicated at 702, 703, 704 and 705 which it will be observed are respectively in the same longitudinal zones as the contacts 671, etc., so that, upon the arrival of a perforation in the band between a contact and a contact lever, an electric impulse will be sent through the circuit thus closed for effecting the desired action depending upon the magnet circuit affected. Bearing in mind that these contacts 671 to 674 lead to the several controlling magnets, it will be understood that the arrangement of the controlling perforations 702 to 705 in the controlling band will depend upon the result desired. This will be more fully explained in connection with the description of the operation of the machine, but in passing it may be noted that closing the circuit through contact 671 throws in the clutch upon the cam-shaft 25 to cause the cam-shaft to rotate, with the result that fastener-members are produced by the presses Nos. 1, 2, 3, and 4 and passed to the point of attaching them to the beaded edge of the tape or stringer; an electric impulse through contact 672 releases the latch-lever 654 to throw out the clutch on the cam-shaft with the result that the cam-shaft will stop rotating and no more fastener-members will be made until it is again started, during which period of idleness of the cam-shaft, the rest of the machine will continue to operate with the result that an excess or blank part of the folded tape or stringer will be produced after the completion of the mounting of a group or series of fastener-members; and when an electric impulse is passed through contact 673 the cut-off shears will be operated for severing the web a spaced length after the completion of a group of fastener-members; while the final contact 674 sends an impulse to the magnet 727 of the mechanical counter at the completion of each stringer, so that said counter will be able to ultimately stop the complete machine by throwing out the main circuit switch when the required number of stringers of the desired length and number of fastener-members has been delivered.

In the plan of operation of the machine shown diagrammatically in Figure 83 (Sheet 27) of the drawings, the mechanical counter 726 closes the electric controlling circuit at 728 which energizes magnet 729 which pulls open the main circuit switch 730 which cuts off the current to the motor 657 through rheostat 731 and thereby stops the machine. As the current is cut off from rheostat 731 the deenergizing of the magnet 732 of the rheostat releases the rheostat arm 733 to permit its usual spring (not shown) to move it to neutral position, where it engages contact lever 734 and breaks the control circuit in which are included the electromagnets and the relays hereinbefore referred to.

It will be understood that the controlling insulated endless band 686 must be driven in a step-by-step manner, one step for each revolution of the machine. This is accomplished by providing the lower sprocket spool 689 with a sleeve 706 carrying a ratchet wheel 707 which is normally engaged by a retaining spring-pressed dog or pawl 708 pivoted to upright 668 upon stud 709. This ratchet wheel 707 is also engaged and driven by a pawl or dog 710 pivoted at 711 to a reciprocating bar 712 mounted upon a plate 713 surmounting a bracket 714 of the machine frame. This bar 712 is confined by the guide brackets 716 and 716 secured to the plate 713 in spaced relation to permit the projection laterally from both sides of bar 712 of a rod 717, which rod is engaged at its ends by coil springs 718 attached to the sides of bracket 715. The springs 718 yieldingly hold the pawl-carrying bar 712 toward the left or away from the ratchet wheel 707, said bar 712 having a bifurcated end 719 in which is freely journalled an anti-friction roller 720 supported in the path of a cam member 721 fastened to the periphery of the rotary sleeve 569 so that once for each revolution of the sleeve the bar 712 carrying pawl 710 will receive an impulse and move the endless band 686 upon the sprocket spools 689 one step, which, as a matter of preference, is the distance between two fastening-members on the beaded tape. The pawl or dog 710 is yieldingly held in engagement with the ratchet wheel 707 by means of a leaf spring 722 fastened to the bracket guide 716. As shown in Figures 2a (Sheet 3), 3 (Sheet 4) and 61 (Sheet

23) of the drawings, a latching bar 723 having notch 724 is pivoted at 725 to upright frame piece 668 in position to engage rod 717 and hold bar 712 in its retracted position when it is desired to arrest the operation of the automatic initiative control.

In several of the figures of the drawings showing the flexible web or stringer the same has been indicated by the reference numeral 429 whatever stage the webbing may be in and the completed fastener-members after being cut from the continuous strip are indicated by the reference numeral 43x, whether said members are in the grippers of the carrier or are clamped in final position upon the beaded edge of the tape or stringer 429.

The machine has been designed to produce stringers for flexible closures having the essential features of patents hereinbefore referred to, but it should be understood that many features of the improved automatic machine may be employed for producing other forms of stringers for flexible closures.

General operation

The operation of the various mechanisms combined in the improved machine to produce the desired results have been individually explained in connection with the foregoing structural description so that a brief reference only will be made to the general operation of the machine.

It will be clear from the foregoing description that the several presses operate successively upon a continuous metal strip-blank which is fed in a step-by-step manner, one step of the width of a fastener-member for each revolution of the machine.

While the successive presses are acting upon the metal blank to produce fastener-members of the form above described, the tape-forming mechanism is at the same time acting upon a continuous web of tape which is doubled into two-ply and formed at its folded longitudinal edge with a four-ply beaded or thickened portion.

When the feed of the metal strip-blank is taking place by the action of press No. 1, assisted by the auxiliary feed as has been explained, all the other presses are raised and out of contact with the work.

Immediately following the feed of the strip-blank by press No. 1 and the auxiliary feed, press No. 2 comes into action, does its work, and remains in engagement with the work until after press No. 1 has released its hold upon the work and returned to its initial position. Press No. 2 and the preliminary clamp and guiding rolls cooperate in holding the strip-blank against movement while the press No. 1 releases the strip and returns to its initial position preparatory to another feeding stroke. The clamp is normally in engagement with the metal strip-blank and is disengaged therefrom only while press No. 1 is feeding the blank.

Completed metal fastener-members are taken from press No. 4 and moved over to position to be clamped upon the beaded edge of the formed tape or stringer. The fastener-member-carrier returns to take a fastener-member just as the feed of the metal strip-blank is completed, and just prior to said carrier reaching its position to receive a new member, press No. 4 starts to operate; its first operation being to cause its pilot member to engage a perforation of the metal strip to accurately position the fastener-member that is to be cut off, then to actuate the gripper of the carrier to cause it to grab and firmly hold the projected fastener-member, and finally to cut off the grabbed fastener-member and cause the release of the auxiliary feed from the metal strip. These last two actions of cut-off and releasing the auxiliary feed take place about the same time.

The carrier with the gripped fastener-member moves away from press No. 4 into position for clamping the member upon the tape, and when it reaches this position in the vertical transverse plane of the beaded tape, the carriage which supports the tape folding mechanism is given a quick movement toward the fastener-member which is rigidly supported by the gripper with its open yoke presented forwardly. This movement carries the beaded edge of the folded tape into the open yoke of the fastener-member and, as the movement is completed, the clencher bars clamp the yoke of the fastener-member upon the beaded edge of the tape or stringer.

These operations are repeated once for each revolution of the machine, the successive fastener-members being properly spaced upon the beaded tape or stringer by the mechanism described including the step-by-step feed mechanism. The required number of fastener-members having been applied to the tape or stringer, the mechanism for forming the fastener-members is thrown out of action by the initiative automatic control above described acting to throw out the clutch upon the cam-shaft,—the feed of the tape continuing while the production and mounting of the fastener-members is discontinued,— there will be a blank portion of tape succeeding a group of fastener-members. When this blank part of the tape is of the desired predetermined length, the cam-shaft is again automatically thrown into action to continue production and mounting of the fastener-members, this resumption of operation of the cam-shaft being effective through the initiative control in the manner already explained. Following the continued mounting of fastener-members upon the tape the tape cut-off is actuated at the proper moment to sever a blank portion of tape midway between two groups of fastener-members and a severed complete stringer is discharged by the chute 618. This production of stringers that are uniform in length, number of fastener-members and their blank ends is continued automatically by the machine until, as above explained with reference to Figure 83 (Sheet 27) of the drawings, the mechanical counter 726 has recorded the required number of completed stringers when, through the electrical controls explained, it will automatically shut off the operation of the machine.

We claim:—

1. In a machine for making separable fastener stringers, the combination with means for forming a beaded carrier or stringer, of means associated therewith for clamping fastener-members thereon.

2. In a machine for making separable fastener stringers, the combination with means for forming a two-ply beaded carrier or stringer, of means associated therewith for clamping fastener-members thereon.

3. In a machine for making separable fastener stringers, the combination with means for forming a continuous beaded carrier or stringer, of means associated therewith for clamping fastener-members thereon.

4. In a machine for making separable fastener tringers, the combination with means for forming a continuous beaded carrier or stringer, of neans associated therewith for intermittently lamping fastener-members thereon, and means lso associated therewith for severing sections of he stringer.

5. In a machine for making separable fastener tringers, the combination with means for forming a continuous beaded carrier or stringer, and neans for intermittently feeding said carrier r stringer, of means associated with said forming nd feeding means for intermittently clamping astener-members thereon.

6. In a machine for making separable fastener tringers, the combination with means for forming a beaded carrier or stringer, of means asociated with said carrier forming and fastener nember forming means for forming fastenernembers, and means for clamping fastenernembers upon the beaded carrier or stringer.

7. In a machine for making separable fastener tringers, the combination with means for supporting a carrier or stringer, of means for forming an integrally connected series of partially nished fastener-members including means for orming separate mounting yokes extending ransversely of the series, means for feeding said astener-members, means for separating from the eries and completing individual fastener-memers, means for supporting completed individual astener-members, and means for clamping fasener-members upon said carrier or stringer.

8. In a machine for making separable fastener tringers, the combination with means for formng a beaded carrier or stringer, and means for eeding said carrier or stringer, of means asociated with said carrier forming and feeding neans for forming a connected series of partially nished fastener-members, means for separating rom the series and completing individual fasener-members, and means for clamping fasener-members upon the beaded carrier or tringer.

9. In a machine for making separable fastener tringers, the combination with means for formng a beaded carrier or stringer, and means for eeding said carrier or stringer, of means asociated with said carrier forming and feeding neans for forming a connected series of fasener-members, means for severing individual nembers from said connected series, and means or clamping fastener-members upon the beaded arrier or stringer.

10. In a machine for making separable fastener tringers, the combination with means for formng a beaded carrier or stringer, of means associted therewith for forming a connected series of astener-members having oppositely presented astening hooks and U-shaped mounting yokes, neans for severing individual members from the onnected series, and means for clamping the -shaped yokes of fastener-members upon the eaded carrier or stringer.

11. In a machine for making separable fastener tringers, the combination of means for folding a bbon of flexible material into a two-ply carrier r stringer having a thickened folded edge, with neans for clamping individual interlocking elenents at uniform intervals upon the thickened olded edge.

12. In a machine for making separable fastener tringers, the combination of means for folding a bbon of flexible material into a two-ply carrier r stringer having a thickened folded edge, with means for forming individual interlocking elements, and means for clamping the individual interlocking elements at uniform intervals upon the thickened folded edge.

13. In a machine for making separable fastener stringers, the combination of means for folding a ribbon of flexible material into a two-ply carrier or stringer having a thickened folded edge, and means for imparting a step-by-step feed to said carrier or stringer, with means for forming a connected series of fastener-members, means for severing individual members from said connected series, means supporting individual fastener-members while they are applied to the carrier or stringer, and means for clamping fastener-members upon the thickened folded edge of the carrier or stringer.

14. In a machine for making separable fastener stringers, the combination with means for folding a ribbon of flexible material into a two-ply carrier or stringer having a four-ply folded edge, with means for clamping individual interlocking elements at uniform intervals upon the four-ply folded edge.

15. In a machine for making separable fastener stringers, the combination with means for folding a ribbon of flexible material into a two-ply carrier or stringer having a four-ply folded edge, with means for forming individual interlocking elements having U-shaped mounting jaws or yokes, and means for clamping the jaws or yokes of said interlocking elements at uniform intervals upon the four-ply folded edge.

16. Means for forming fastener-elements having tape receiving jaws, and means for firmly supporting individual fastener-elements, in combination with a carriage movable toward and away from said element supporting means, means for feeding a tape upon said carriage transversely of said element supporting means, means for forming a bead upon a tape, and means for clamping the individual fastener-elements upon the beaded edge of a tape.

17. Means for forming fastener-elements having tape receiving jaws, and means for firmly supporting individual fastener-elements, in combination with a carriage movable toward and away from said element supporting means, tape feeding means upon said carriage for feeding a tape transversely of said element supporting means, means for forming a bead upon a tape, means for clamping individual fastener-elements upon the beaded edge of a tape, and means for uniformly spacing the fastener-elements upon a tape.

18. Means for forming fastener-elements having tape receiving jaws, and means for supporting individual fastener-elements, in combination with a carriage movable toward and away from said element supporting means, means upon said carriage for supporting and feeding a tape transversely of said element-supporting means, means for longitudinally folding a tape and forming a bead upon its folded edge, and means for clamping individual fastener-elements upon the folded beaded edge of a tape.

19. The combination of means for supporting a fastener-element, with a tape carriage movable toward and away from said supporting means, tape folding mechanism mounted upon said carriage, mechanism to feed a tape at an angle to the movement of said carriage, and means for securing fastener-elements upon a tape.

20. The combination of means for supporting a fastener-element, with a tape carriage movable

toward and away from said supporting means, means mounted upon said carriage for forming a fastener retaining bead upon a tape, mechanism to feed a tape at an angle to the movement of said carriage, and means for securing fastener-elements upon a tape.

21. The combination of means for supporting a fastener-element, with a tape carriage movable toward and away from said supporting means, tape folding and bead forming mechanism mounted upon said carriage, mechanism to feed the tape at an angle to the movement of said carriage, and means for securing fastener-elements upon a tape.

22. The combination of means for supporting a fastener-element, with a tape carriage movable toward and away from said supporting means, tape folding and bead forming mechanism mounted upon said carriage, mechanism to feed the tape at an angle to the movement of said carriage, and means for clamping individual fastener-elements upon the folded beaded edge of a tape.

23. The combination of means for forming a connected series of fastener-members, means for severing individual members from said connected series, and means for supporting an individual fastener-element, with a tape carriage movable toward and away from said supporting means, means mounted upon said carriage for forming a folded plural ply fastener-retaining bead upon a tape, mechanism to feed a tape upon said carriage, and means for securing fastener elements upon a tape.

24. The combination of means for forming a connected series of fastener-members, means for severing individual members from said connected series, and means for supporting an individual fastener-element, with a tape carriage movable toward and away from said supporting means, means mounted upon said carriage for forming a folded plural ply fastener-retaining bead upon a tape, mechanism to feed a tape upon said carriage, means for securing fastener elements upon a tape, and mechanism for cutting off lengths from a tape.

25. The combination of means for intermittently feeding a flat blank strip, means acting upon said strip for forming a succession of fastener-elements including means for forming separate mounting yokes in the plane of said strip, means for severing successive fastener-elements from said strip, means movable toward and away from said fastener-elements adapted to grip a fastener-element and move it away, tape-supporting mechanism adapted to intermittently move a carrier tape toward a separately supported fastener-element, and means for clamping fastener-elements upon a carrier tape.

26. The combination of means for intermittently feeding a flat blank strip, means acting upon said strip for forming a succession of connected fastener-elements having oppositely presented hooks including means for forming separate mounting yokes from said strip, means for severing successive fastener-elements from said strip, a travelling gripper movable toward and away from said fastener-elements adapted to grip a fastener-element and move it away from the strip as it is severed therefrom, tape-supporting mechanism adapted to intermittently move a carrier tape toward and into the mounting yoke of a separately supported fastener-element, means for clamping fastener-elements upon the carrier tape, and means for intermittently feeding the carrier tape.

27. The combination of means for intermittently feeding a flat blank strip, means acting upon said strip for forming a succession of connected fastener-elements including means for forming separate mounting yokes of the material of said strip, means for severing successive fastener-elements from said strip, a travelling gripper adapted to grip a fastener-element and move it away from the strip as it is severed therefrom, and tape-supporting mechanism adapted to intermittently move a carrier tape toward a separately supported fastener-element, and means for clamping the fastener-element upon the carrier tape.

28. The combination of means for supporting and feeding a flat blank strip, means acting upon said blank strip for forming a succession of connected fastener-elements having U-shaped clamping jaws formed of the material of said strip, means for severing successive fastener-elements from said strip, and means for supporting indiivdual fastener-elements while they are applied to a carrier tape, with a carriage reciprocating in the plane of the blank strip, means for feeding the carrier tape upon said carriage transversely of the blank strip, and means upon said carriage for clamping a fastener-element upon the carrier tape when the tape is moved by its carriage into the U-shaped jaws of a fastener-element.

29. In a machine of the character described, the combination with means for forming a two-ply flexible carrier or stringer with a thickened edge, and means uniformly feeding said flexible carrier or stringer, of means clamping fastener-members in spaced relation upon the thickened edge of said carrier or stringer, means supplying fastener-members to said clamping means, and means automatically arresting the supply of fastener-members to said clamping means without interfering with the uniform feed of said carrier or stringer.

30. In a machine of the character described, the combination with means forming a beaded carrier or stringer and means uniformly feeding said carrier or stringer, of means clamping fastener-members in spaced relation upon said carrier or stringer, means supplying fastener-members to said clamping means, and means automatically arresting the supply of fastener-members to said clamping means without interfering with the uniform feed of said carrier or stringer.

31. In a machine of the character described, the combination with means uniformly feeding a flexible carrier or stringer, and means for clamping fastener-members upon said carrier or stringer, of means for forming fastener-members, means conveying fastener-members into position to be clamped upon said carrier or stringer, and means for arresting said fastener forming means and said conveying means without interrupting the feed of the carrier or stringer.

32. In a machine of the character described, the combination with means for forming a flexible carrier or stringer, means uniformly feeding said flexible carrier or stringer, and means for clamping fastener-members upon said carrier or stringer, of means for forming a connected series of fastener-members, means for severing individual members from the connected series, means for conveying fastener-members

nto position to be clamped upon said carrier or tringer, and means for arresting said forming, evering and conveying means without interrupt-ng the feed of the carrier or stringer.

33. In a machine of the character described, he combination with feeding means for a flexi-le carrier or stringer, means for conveying fas-ener-members, means for clamping fastener-nembers upon said carrier or stringer, power riven mechanism for operating said carrier feed-ng means and said fastener conveying means, nd an automatically controlled clutch between aid power mechanism and said fastener convey-ng means, whereby the supply of fastener-mem-ers can be arrested and the feed of the carrier r stringer continued to produce blank portions hereon.

34. In a machine of the character described, he combination with feeding means for a flexi-le carrier or stringer, means for forming fas-ener-members, means for conveying fastener-nembers, and means for clamping fastener-mem-ers upon said carrier or stringer, of power driv-n mechanism for operating said carrier feed-ng means, said fastener forming means and said astener conveying means, and an automatically ontrolled clutch between said power mechanism nd said fastener forming and conveying means, hereby the supply of fastener-members can be rrested and the feed of the carrier or stringer ontinued to produce blank portions thereon.

35. In a machine of the character described, ne combination with means for forming a flex-ole carrier or stringer, feeding means for said exible carrier or stringer, means for forming astener-members, means for conveying individ-al fastener-members, and means for clamping astener-members upon said carrier or stringer, f power driven mechanism for operating said arrier forming and feeding means and said fas-ener forming and conveying means, and an au-omatically controlled clutch between said power nechanism and said fastener forming and con-eying means, whereby the supply of fastener-nembers can be arrested and the forming and eeding of the carrier or stringer continued to roduce blank portions thereon.

36. In a machine of the character described, ne combination with feeding means for a flexible arrier or stringer, means for forming fastener-nembers, means for conveying individual fas-ener-members, means for clamping fastener-nembers upon said carrier or stringer, power riven mechanism for operating said carrier feed-ng means and said fastener forming and con-eying means, and an automatically controlled lutch between said power mechanism and said astener forming and conveying means, where-y the supply of fastener-members can be ar-ested and the feed of the carrier or stringer ontinued to produce blank portions thereon.

37. In a machine for making separable fasten-r stringers, the combination with means for orming a continuous connected strip of fasten-r-members, including means for forming later-lly and oppositely projecting fastener hooks and eparate pairs of U-shaped clamping jaws, means or severing individual fastener-members from ne strip, means for presenting individual sev-red members with their U-shaped jaws in string-r-receiving position, means for moving a car-ier or stringer into said U-shaped jaws, and neans for clamping said jaws upon the carrier r stringer.

38. In a machine for making separable fas-tener stringers, the combination with means for moving a metal strip-blank step-by-step lengthwise, means for shaping said blank into a connected series of fastener-members arranged transversely of the blank, including means for forming separate pairs of U-shaped jaws along one edge and fastening hooks along the opposite edge of the blank, means for severing individual fastener-members from the strip, means for conveying individual members from said strip and presenting their U-shaped jaws in stringer receiving position, means for moving a carrier or stringer into said U-shaped jaws, and means for clamping said jaws upon the carrier or stringer.

39. In a machine for making separable fastener stringers, the combination with means for feeding a flat metal strip-blank, of means acting upon said blank to form a succession of connected interlocking elements for slide fasteners, and means for severing the connections between individual interlocking elements and forming from the severed parts of said connections integral riding lugs upon the separated interlocking elements.

40. In a machine for making separable fastener stringers, the combination with means for feeding a flat metal strip-blank, of means acting upon said blank to form a succession of connected side by side interlocking elements for slide fasteners having oppositely presented mounting jaws and fastener-members, and means for separating individual fastener-elements and forming thereon integral riding lugs.

41. In a machine of the character described, the combination with means for intermittently feeding a metal strip-blank, of means acting upon said blank to form a succession of connected fastener-elements, buffing means operating intermittently upon the connected series of fastener-elements, and means for severing the connections between individual fastener-elements.

42. In a machine of the character described, the combination with means for intermittently feeding a metal strip-blank, of means acting upon said blank to form a succession of connected fastener-elements, a pivotally mounted frame movable toward and away from said blank, buffing wheels journalled in said frame, driving means for said buffing wheels, means rocking said frame, and means for severing the connections between individual fastener-elements.

43. In a machine of the character described, the combination with means for intermittently feeding a metal strip-blank, of means acting upon said blank to form a succession of connected fastener-elements having mounting jaws, a carrier having an element gripper, buffing means operating intermittently upon the connected series of fastener-elements, means for severing the connections between individual fastener-elements, means supporting a flexible carrier tape movable toward said element gripper, and means for clamping elements upon said carrier tape.

44. In a machine of the character described, the combination with means for feeding a connected series of fastener-elements, of an element cut-off, an element gripper, a pilot member adapted to accurately position a fastener-element with reference to the cut-off and gripper, and means for actuating said pilot member, said gripper, and said cut-off to effect the gripping of a cut-off element.

45. In a machine of the character described, the combination with means for feeding a connected series of fastener-elements, of an element cut-off, an element gripper, a pilot member adapted to accurately position a fastener-element with reference to the cut-off and gripper, and common operating means for successively actuating said pilot member, said gripper and said cut-off to effect the gripping of a cut-off element.

46. In a machine of the character described, the combination with means for feeding a connected series of fastener-elements, of an element cut-off mechanism, an element gripper mechanism, a pilot member adapted to accurately position a fastener-element with reference to the cut-off and gripper mechanisms, and a reciprocating plunger adapted to operate said pilot member and said gripper and cut-off mechanisms.

47. In a machine of the character described, the combination with means for feeding a connected series of fastener-elements, of an element cut-off mechanism, an element gripper mechanism, a pilot member adapted to accurately position a fastener-element with reference to the cut-off and gripper mechanisms, and a reciprocating plunger adapted to successively operate said pilot member, said gripper mechanism and said cut-off mechanism.

48. In a machine of the character described, the combination with means for feeding a connected series of fastener-elements, of an element cut-off mechanism, an element gripper mechanism, an operating plunger carrying tappets adapted to actuate said gripper and cut-off mechanisms, and a pilot member mounted upon said plunger and adapted to engage the connected series of fastener-elements when the plunger moves to operate the gripper and cut-off mechanisms.

49. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member, a movable upper gripper member, and a latching device arranged to latch the movable gripper member in closed position.

50. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member, a movable upper gripper member, a spring normally holding the movable gripper member open, and a latching device arranged to latch the movable gripper member against motion.

51. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member, a movable upper gripper member, a spring acting upon said movable gripper member, and a spring actuated latching device arranged to latch the movable gripper member in either open or closed position.

52. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member formed with a recessed face to receive a fastener-element, and a movable gripper member pivoted upon the carriage adjacent to said fixed member and formed with a projecting nose shaped to fit over a fastener-element and clamp it against said recessed face of the fixed gripper member.

53. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member formed with a recessed face to receive a fastener-element, a movable gripper member pivoted upon the carriage adjacent to said fixed member and formed with a projecting nose shaped to fit over a fastener-element and clamp it against said recessed face of the fixed gripper member, and a spring latch controlling said movable gripper member.

54. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member formed with a recessed face to receive a fastener-element, a movable gripper member pivoted upon the carriage adjacent to said fixed member and formed with a projecting nose shaped to fit over a fastener-element and clamp it against said recessed face of the fixed gripper member, a spring acting upon said movable gripper member, and a latch controlling said movable gripper member.

55. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a lower fixed gripper member, an upper movable gripper member pivoted upon the carriage and movable toward and away from said fixed gripper member, a latching lever pivoted upon said carriage adjacent to said movable gripper member, said latching lever being movable transversely of the plane of movement of said movable gripper member and adapted to frictionally engage a face of said gripper member to yieldingly hold the gripper open or to engage a rear edge of the movable gripper member to firmly lock the gripper closed upon a fastener-element.

56. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a fixed gripper member, a movable gripper member pivoted upon the carriage and movable toward and away from said fixed gripper member, a latching lever pivoted upon said carriage and movable into engagement with said movable gripper member to firmly lock the gripper closed upon a fastener-element, and a timed tripping device to disengage said latch from said movable gripper member for releasing it.

57. In a machine of the character described, the combination with means for feeding fastener-elements, of a carriage having a fixed gripper member and a movable gripper member, a gripper latching lever pivoted upon said carriage adjacent to said movable gripper member, a trip lever upon the carriage controlling said latching lever, and a power operated device periodically thrown into engagement with said trip lever.

58. In a machine of the character described, the combination with means for feeding a series of connected fastener-elements, of the fixed and movable cut-off members in the path of said fastener elements, said movable cut-off member being spring supported in its inactive or retracted position, a gripper carriage having the cooperating fixed gripper member and movable gripper member, said movable gripper member being spring supported in its open position, and an operating plunger adapted to act upon said movable gripper member and said movable cut-off member to grip an element severed from the series.

59. In a machine of the character described, the combination with means for feeding a series of connected fastener-elements, of fixed and movable cut-off members in the path of said

fastener-elements, said movable cut-off member being spring supported, a gripper carriage having a fixed gripper member and a movable gripper member, said movable gripper member being spring supported, an operating plunger carrying tappets adapted to act successively upon said movable gripper member and said movable cut-off member to grip an element severed from the series, and a pilot member mounted upon said operating plunger and adapted to engage the connected fastener-elements and accurately position an element with reference to the cut-off and gripper members.

60. In a machine of the character described, the combination with means for feeding a connected strip of fastener-elements including a pronged plate adapted to be moved into and out of engagement with said strip, of an element cut-off mechanism, an element gripper mechanism, an operating plunger for actuating said gripper and cut-off mechanisms, a pilot member operated by said plunger adapted to accurately position a fastener-element with reference to the cut-off and gripper mechanisms, and means actuated by said plunger for disengaging said pronged feed plate from said strip of elements when the pilot member is in action, and move said pronged feed plate into engagement with said strip when the pilot member is withdrawn.

61. In a machine for making separable fastener stringers, the combination with means for feeding a ribbon or tape, of means acting upon said ribbon or tape to form thereon a thickened bead, and means for securing individual interlocking elements at uniform intervals upon said thickened bead.

62. In a machine of the character described, the combination with means for supporting and feeding a ribbon or tape, of means acting upon said ribbon or tape to longitudinally fold a four-ply thickened bead thereon, and means for securing fastener-elements upon said thickened bead.

63. In a machine of the character described, the combination with means for supporting and feeding a ribbon or tape, of means acting upon said ribbon or tape to longitudinally fold a four-ply thickened bead thereon, means for securing fastener-elements upon said thickened bead, and mechanism for cutting off lengths of said beaded ribbon or tape.

64. In a machine of the character described, the combination with means for longitudinally folding a ribbon or tape, of a pair of cooperating bead forming members respectively grooved and ribbed to act upon the inner and outer faces of the fold of a ribbon or tape to reverse the crown of the fold and produce a thickened folded bead and means for securing fastener elements upon said bead.

65. In a machine of the character described, the combination with means for longitudinally folding a ribbon or tape, a pair of rollers formed with concave peripheries freely journalled upon a support projecting between the two-plies of the folded ribbon or tape, and a roller having a convex periphery mounted outside of and adjacent to the fold of the ribbon or tape and adapted to press the crown of the fold into the concave peripheries of said first-named pair of rollers, for reversing the crown of the fold and producing an integral thickened bead or folded edge upon the ribbon or tape, means for forming fastener-elements with open mounting jaws, means for presenting the thickened or beaded edge of the folded tape in the open jaws of said fastener-elements, and means for clamping the jaws of said elements upon the tape.

66. In a machine of the character described, the combination with means for longitudinally folding and beading a ribbon or tape, of intermittently acting feeding mechanism comprising tape engaging gripper bars movable toward each other to grip the tape and away from each other to release the tape, and a pair of actuating cam-bars having pin and slot engagement with said gripper bars, said cam-bars having limited relative movements upon said gripper bars for moving them into and out of engagement with the folded ribbon or tape, and further movements with the gripper bars to effect the feed of the tape.

67. In a machine of the character described, the combination with means for longitudinally folding and beading a ribbon or tape, of intermittently acting feeding mechanism comprising tape engaging gripper bars movable toward each other to grip the tape and away from each other to release the tape, means for forming fastener-elements having mounting yokes, means for presenting the beaded edge of the tape in the yokes of said elements, plungers carrying clenching devices adapted to clamp the yokes of elements upon the tape, and a pair of actuating cam-bars having pin and slot engagement with said gripper bars, and pin and slot engagement with the clencher carrying plungers, said cam-bars having a limited relative movement upon said gripper bars and said plungers for moving them into and out of engagement with the tape, and movements with the gripper bars to cause the feed of the tape when the gripper bars are gripped thereon and to retract the gripper bars for a new grip upon the tape when the gripper bars are free from the tape.

68. In a machine of the character described, the combination with means for longitudinally folding and beading a ribbon or tape, of intermittently acting feeding mechanism comprising tape engaging gripper bars movable toward each other to grip the tape and away from each other to release the tape, plungers carrying clenching devices adapted to clamp fastener-elements upon the tape, a pair of actuating cam-bars having pin and slot engagement with said gripper bars, and pin and slot engagement with said clencher carrying plungers, said cam-bars having a limited relative movement upon said gripper bars and clencher carrying plungers for moving them into and out of engagement with the tape, and automatic latches carried by said cam-bars and engaging parts upon said gripper bars to cause the gripper bars to travel with the cam-bars.

69. In a machine of the character described, the combination with means for longitudinally folding and beading a ribbon or tape, of a pair of tape feeding gripper bars, a pair of operating cam-bars formed with oppositely arranged cam slots in which engage anti-friction rollers journalled upon said gripper bars, and automatic latches carried by said cam-bars and engaging parts upon said gripper bars, said latches causing the gripper bars to travel with the cam-bars when they are in engagement and allowing relative motion when they are disengaged.

70. In a machine of the character described, the combination with means for longitudinally folding and beading a ribbon or tape, of a pair of tape feeding gripper bars, spring mechanism operating upon said gripper bars, a pair of operating cam-bars formed with oppositely ar-

ranged cam slots in which engage anti-friction rollers journalled upon said gripper bars, automatic latches carried by said cam-bars and engaging lugs upon said gripper bars, said latches causing the gripper bars to travel with the cam-bars when they are in engagement, and means for operating said cam-bars.

71. In a machine of the character described, the combination with means for longitudinally folding a ribbon or tape, of means for feeding said tape through the folding means, spring actuated plungers operating transversely of the path of the folded tape, each of said plungers being formed at its inner end with spaced lugs adapted to fit over and gauge previously attached fastener-elements, means for clamping fastener units upon the folded edge of the tape in proper spaced relation to the previously attached units, and means for operating said plungers.

72. In a machine of the character described, the combination with means for longitudinally folding a ribbon or tape, of means for feeding said tape through the folding means, spring actuated plungers operating transversely of the path of the folded tape, each of said plungers carrying clenching blades projecting inwardly and adapted to clamp fastener units upon the folded edge of the tape, and means for operating said plungers.

73. In a machine of the character described, the combination with means for longitudinally folding and beading a ribbon or tape, of means for feeding said tape through the folding and beading means, guideways extending transversely of the path of the folded tape, spring actuated plungers operating in said guideways, each of said plungers being formed at its inner end with spaced lugs adapted to fit over and gauge previously attached fastener-elements, auxiliary plungers mounted upon said main plungers, clenching tools projecting inwardly from said auxiliary plungers and adapted to clamp fastener-elements upon the beaded folded edge of the tape in proper spaced relation to the previously attached units, and means for operating said plungers.

74. In a machine of the character described, the combination with means for producing a flexible carrier tape or stringer, means for feeding said stringer, and means for presenting fastener-elements in position to be clamped upon the stringer, of slotted main plungers operating transversely of the path of the stringer toward and away from each other, each main plunger being formed at its inner end with spaced gauging lugs to fit over previously attached fastener-elements, auxiliary plungers sliding in guidways of said main plungers, clenching tools mounted upon said auxiliary plungers adapted to clamp fastener-elements upon said flexible stringer, a pair of operating cam-bars formed with oppositely arranged cam slots, the said cam-bars extending through said slotted main plungers, and anti-friction rollers journalled upon said auxiliary plungers and engaging the cam slots of said cam-bars.

75. In a machine of the character described, the combination with means for producing a flexible carrier tape or stringer, means for feeding said stringer, and means for presenting fastener-elements in position to be clamped upon the stringer, of vertically slotted guideways extending transversely of the path of the stringer, longitudinally slotted main plungers operating in said guideways toward and away from each other, each main plunger being formed at its inner end with spaced gauging lugs to fit over previously attached fastener-elements, auxiliary plungers mounted on said main plungers and having limited sliding movement thereon, clenching tools upon said auxiliary plungers adapted to clamp fastener-elements upon said flexible stringer, a pair of operating cam-bars formed with oppositely arranged cam slots, the said cam-bars extending through the guide slots of said guideways and said main plungers, and anti-friction rollers journalled upon said auxiliary plungers and engaging the cam slots of said cam-bars.

76. In a machine of the character described, the combination with means for producing a flexible carrier tape or stringer, means for feeding said stringer, and means for presenting fastener-elements in position to be clamped upon the stringer, of slotted guideways extending transversely of the path of the stringer, longitudinally slotted and channeled main plungers operating in said guideways toward and away from each other, springs engaging said main plungers and yieldingly urging them inwardly, each main plunger being formed at its inner end with spaced gauging lugs to fit over previously attached fastener-elements, auxiliary plungers mounted in the longitudinal channelled guideways of said main plungers and having limited sliding movement therein, clenching tools upon said auxiliary plungers adapted to clamp fastener-elements upon said flexible stringer, a pair of operating cam-bars formed with oppositely arranged cam slots, the said cam-bars extending through the guide slots of said guideways and said main plungers, anti-friction rollers journalled upon said auxiliary plungers and engaging the cam slots of said cam-bars, and means for reciprocating said cam-bars.

77. In a machine of the character described, the combination with mechanism for producing fastener-elements, mechanism for presenting fastener-elements in position for mounting upon flexible stringers, mechanism for producing flexible stringers, and mechanism for clamping fastener-elements upon flexible stringers, of means actuated by the operation of said machine for automatically controlling the operation of said mechanisms.

78. In a machine of the character described, the combination with mechanism for producing fastener-elements, mechanism for presenting fastener-elements in position for mounting upon flexible stringers, mechanism for producing a continuous flexible stringer, mechanism for clamping fastener-elements upon flexible stringers, and mechanism for cutting off lengths of said stringer, of means actuated by the operation of said machine for automatically controlling the operation of said mechanisms.

79. In a machine of the character described, the combination of means for producing fastener-elements, means for producing flexible stringers and mounting said fastener-elements thereon, and a divided power driving mechanism including a clutch, a magnetic control for said power mechanism, a second magnetic control for said clutch, and automatic means operated by the machine for throwing said controls into action.

80. In a machine of the character described, the combination with a power shaft, a cam shaft driven from said power shaft, a clutch arranged between said power shaft and said cam shaft, mechanism operated by said cam shaft for pro-

ducing fastener-elements, mechanisms operated by said power shaft for producing flexible stringers and mounting fastener-elements upon said stringers, a counter controlled throw-out mechanism for said power shaft, and machine operated automatic controls for said clutch.

81. In a machine of the character described, the combination with a power shaft, a cam shaft driven from said power shaft, an automatic clutch arranged between said power shaft and said cam shaft, mechanisms operated by said cam shaft for producing fastener-elements and conveying them to a position for mounting upon a stringer, mechanisms operated by said power shaft for producing a continuous flexible stringer, feeding said stringer and mounting fastener-elements upon said stringer, automatic intermittently acting mechanism for cutting off sections of said continuous stringer having mounted fastener-elements, a counter operated by the machine, throw-out mechanism for said power shaft actuated by said counter, and machine operated automatic controls for said clutch.

82. In a machine of the character described, the combination with a power shaft, a cam shaft driven from said power shaft, an automatic clutch arranged between said power shaft and said cam shaft, mechanism operated by said cam shaft for producing fastener-elements and conveying them into position for mounting upon the flexible stringer, mechanisms operated by said power shaft for producing a continuous flexible stringer, feeding said stringer and mounting fastener-elements upon said stringer, electro-magnetically operated shears for cutting off sections of said stringer carrying mounted fastener-elements, a counter operated by a regularly acting part of the machine, electro-magnetic throw-out mechanism for said power shaft under the control of said counter, electro-magnetic controls for said clutch, and automatic circuit controlling mechanism operated by the machine and in circuit with the shears magnet and the clutch magnetic controls.

83. In a machine of the class described, the combination with means for feeding a continuous flexible stringer and means for applying fastener elements along the edge of said stringer in closely spaced relation, of means for periodically increasing the spacing to group the elements on the stringer, and electrical devices for controlling said last named means including circuit control mechanism operated by the machine.

84. In a machine of the class described, the combination with intermittently operating stepwise feeding means for feeding a continuous flexible stringer, and means for applying fastener elements along the edge of said stringer in closely spaced relation, of means for periodically increasing the amount of stringer feed between successive elements on said stringer to group the elements on the stringer, and electrical devices for controlling said last named means including circuit control mechanism operated by the machine.

85. In a machine of the class described, the combination with means for feeding a continuous flexible stringer, and means for applying fastener elements along the edge of said stringer in closely spaced relation, of means for periodically interrupting the operation of said applying means without interrupting the operation of said feeding means, and electrical devices for controlling said interrupting means including circuit control mechanism operated by the machine.

86. In a machine of the class described, the combination with means for feeding a continuous flexible stringer and means for applying fastener elements along the edge of said stringer in closely spaced relation, of propelling means for said applying means including a clutch, a solenoid for disengaging said clutch, an electrical circuit including said solenoid and a source of electrical energy, and means for controlling said circuit responsive to a predetermined number of operations of said machine for disengaging said clutch and thereby periodically increasing the spacing between elements to group the elements on the stringer.

87. In a machine of the class described, the combination with means for feeding a continuous flexible stringer and means for applying fastener elements along the edge of said stringer in grouped relation, of cut-off shears operated automatically by the machine for severing said stringer between groups of elements.

88. In a machine of the class described, the combination with means for feeding a continuous flexible stringer, means for feeding fastener elements each having spaced apart jaws at one end, and means for placing said jaws astride the edge of said stringer, reciproacting clenching tools operable on opposite sides of said stringer to clench said jaws on the edge of said stringer, and reciprocable gauging lugs adapted to engage over previous attached fastener elements whereby the element being clenched on is properly spaced from the attached elements.

89. The method of forming separable fastener members of the type having separated U-shape clamping jaws at one end, interlocking means at the other end, and riding lugs projecting laterally from the member between said interlocking means and jaws, which comprises feeding a flat metal strip, blanking out from said strip a succession of fastener elements with the mounting jaws and interlocking end at least partially formed, said fastener members being integrally connected side by side by portions of said flat strip, and cutting said members apart at said integral connections and leaving enough of said integral connections to form said riding lugs.

90. The method of forming separable fastener members of the kind having separated compressible jaws at one end and interlocking devices at the other end, which comprises feeding a flat strip of metal equal in width to the overall length of said fastener members, cutting out portions of said strip at the sides of said fastener members and between the jaw portions, leaving a portion of the strip connecting said fastener members in side by side relation, and finally severing the strip between said fastener members.

91. In a machine for making separable fastener stringers, the combination with means for forming a beaded fabric tape and for temporarily holding the bead formation on said tape, of means for supplying fastener members and means for clamping said fastener members around said beaded edge, whereby said bead is held permanently to form.

92. In a machine for making separable fastener stringers, the combination with means for guiding a flat tape, folding devices for folding a portion of said flat tape to form a beaded edge and for temporarily holding the tape in such folded shape, means for supplying fastener members to said beaded edge, and means for clamping said members around said edge whereby the same is held permanently in folded shape.

93. In a machine for making separable fas-

tener stringers, the combination of means for folding a ribbon of flexible material into a two-ply carrier or stringer, with means for clamping individual interlocking elements to the folded edge at uniform intervals.

94. In a machine for making separable fastener stringers, the combination of means for folding a ribbon of flexible material into a beaded two-ply carrier or stringer, with means for clamping individual interlocking elements to the folded edge at uniform intervals.

95. In a machine for making separable fastener stringers, the combination with means for longitudinally folding a ribbon or tape, of means acting upon said folded ribbon or tape to form a thickened folded bead, and means for attaching individual interlocking elements at uniform intervals upon said bead.

96. A ribbon-like strip of thin sheet material having sections cut out along one edge to form mounting jaws of slide fastener members, and sections cut out along the other edge to form spaced portions, said mounting jaws being wholly disposed in the plane of the original flat strip, said spaced portions each being formed to provide the interlocking means of a slide fastener member, said members so formed being integrally connected by severable portions of the strip.

97. A single piece of material presenting in plan view a plurality of Y-shaped outlines representing the Y-shaped external contours of integrally connected slide fastener members each member having spaced apart jaws at one end and an interlocking projection and recess at the other end.

98. The method of forming slide fastener members of the class described which consists of operating on a single piece of material to form a plurality of integrally connected elements presenting in plan view a plurality of Y-shaped outlines each representing the Y-shaped external outline of a slide fastener member with spaced apart jaws on one end of each element and interlocking means on the other end, and separating one element from another to form individual slide fastener members.

99. The method of forming slide fastener members of the class described which consists of cutting away portions from a flat piece of material leaving an integrally connected series of elements each having substantially the Y-shaped external outline of a slide fastener member with spaced apart jaws at one end, forming interlocking means on each element at the other end while the elements are connected, and finally separating one member from another.

100. The method of forming slide fastener members of the class described which consists of cutting away portions from a flat elongated strip of material to leave an integrally connected series of elements having substantially the Y-shaped external outline of slide fastener elements extending transversely of the strip, forming interlocking means on said elements while connected in the strip and finally separating one member from another.

101. The method of forming slide fastener members of the class described which consists of forming a plurality of connected fastener members presenting in plan view a plurality of Y-shaped outlines each representing the Y-shaped external outline of a slide fastener member, with spaced apart jaws on one end of each member and interlocking means on the other end, with the major portion of the exterior edges of said members exposed, operating on said exterior edges for smoothing the same, and then separating one member from another to form individual slide fastener members.

102. The method of forming separable fastener members of the kind having separated compressible jaws at one end and interlocking devices at the other end, which comprises feeding a flat strip of metal equal in width to the overall length of said fastener members, cutting out portions of said strip at the sides of said fastener members and between the jaw portions, leaving a portion of the strip connecting said fastener members in side by side relation, and leaving the major portion of the exterior edges of said fastener members exposed, operating on said exposed edges for smoothing the same, and finally severing the strip between said fastener members.

103. In a machine for making separable fastener stringers, the combination with means for supporting a carrier or stringer, of means for forming an integrally connected series of partially finished fastener members including means for forming separate mounting yokes, means for feeding said fastener members, means for separating from the series and completing individual fastener members, means for supporting completed individual fastener members, and means for clamping fastener members upon said carrier or stringer.

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DEFENDANT'S EXHIBIT "K"

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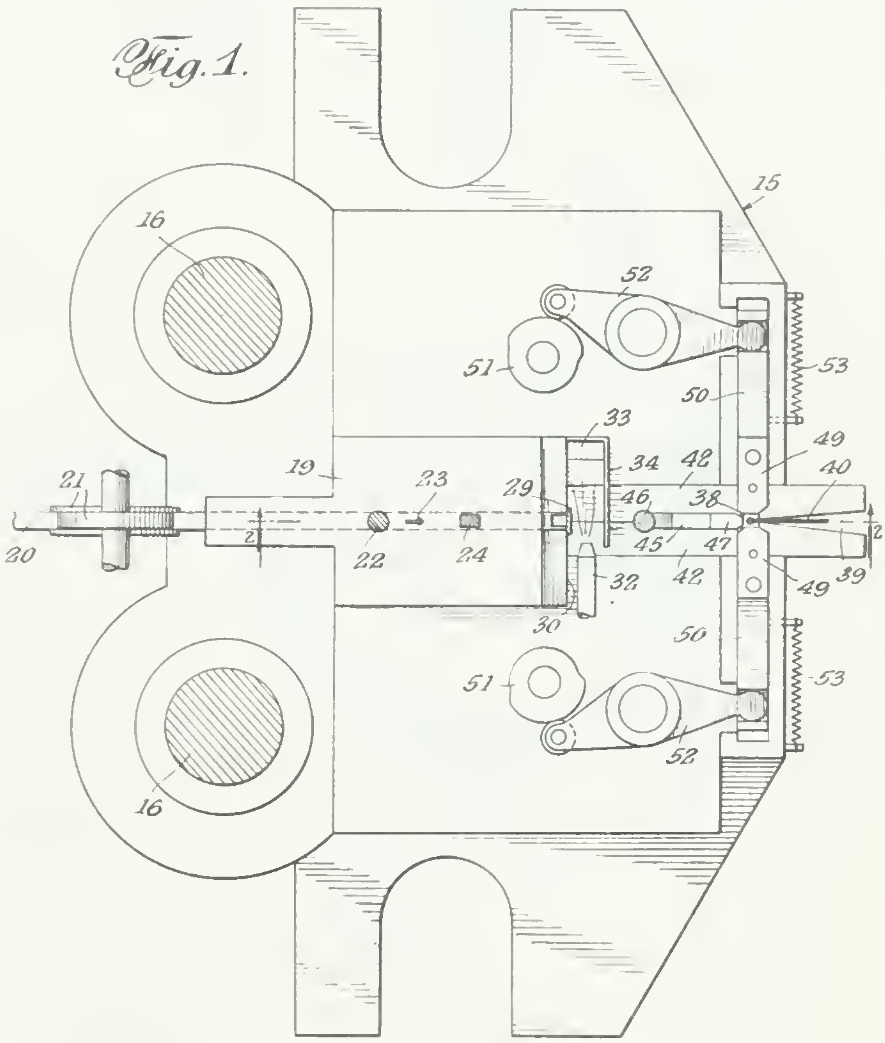
FASTENING MACHINE

Filed March 23, 1940 3 Sheets-Sheet 1

Fig. 1.



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2,294,253

FASTENING MACHINE

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3 Sheets-Sheet 2

Fig. 2.

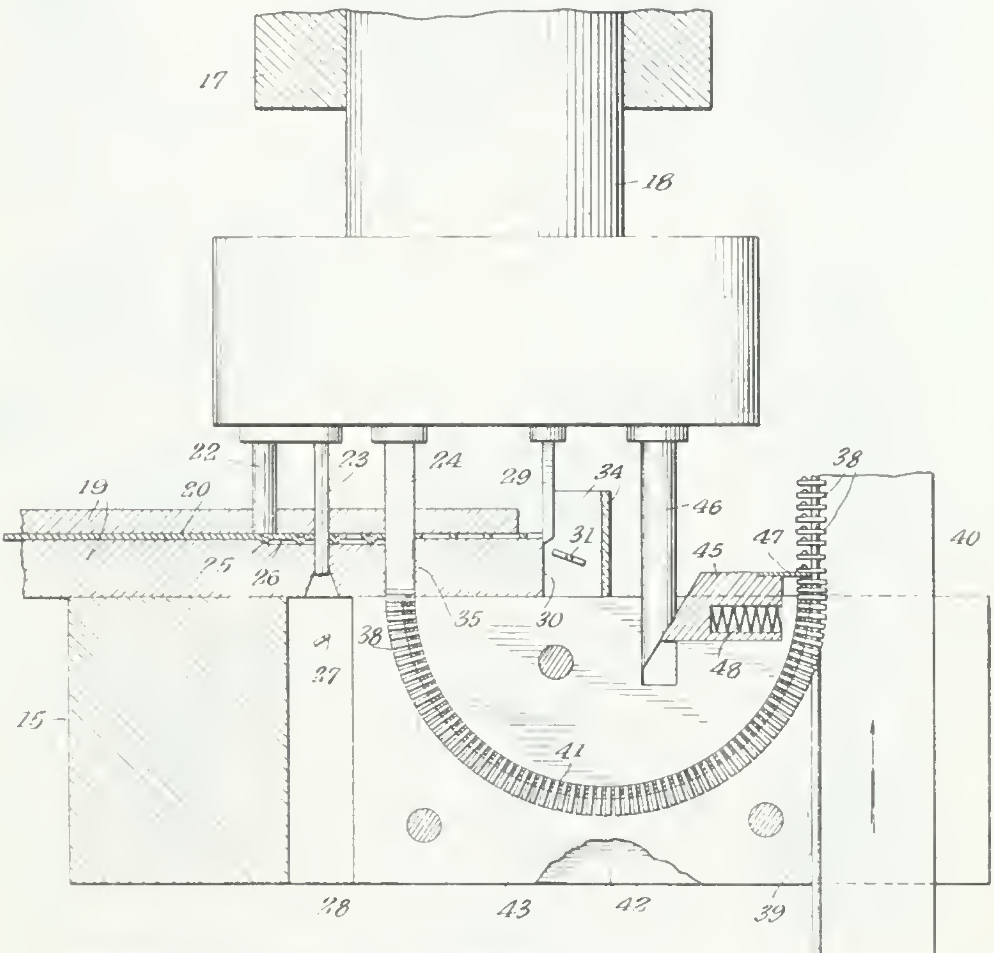

Fig. 3.

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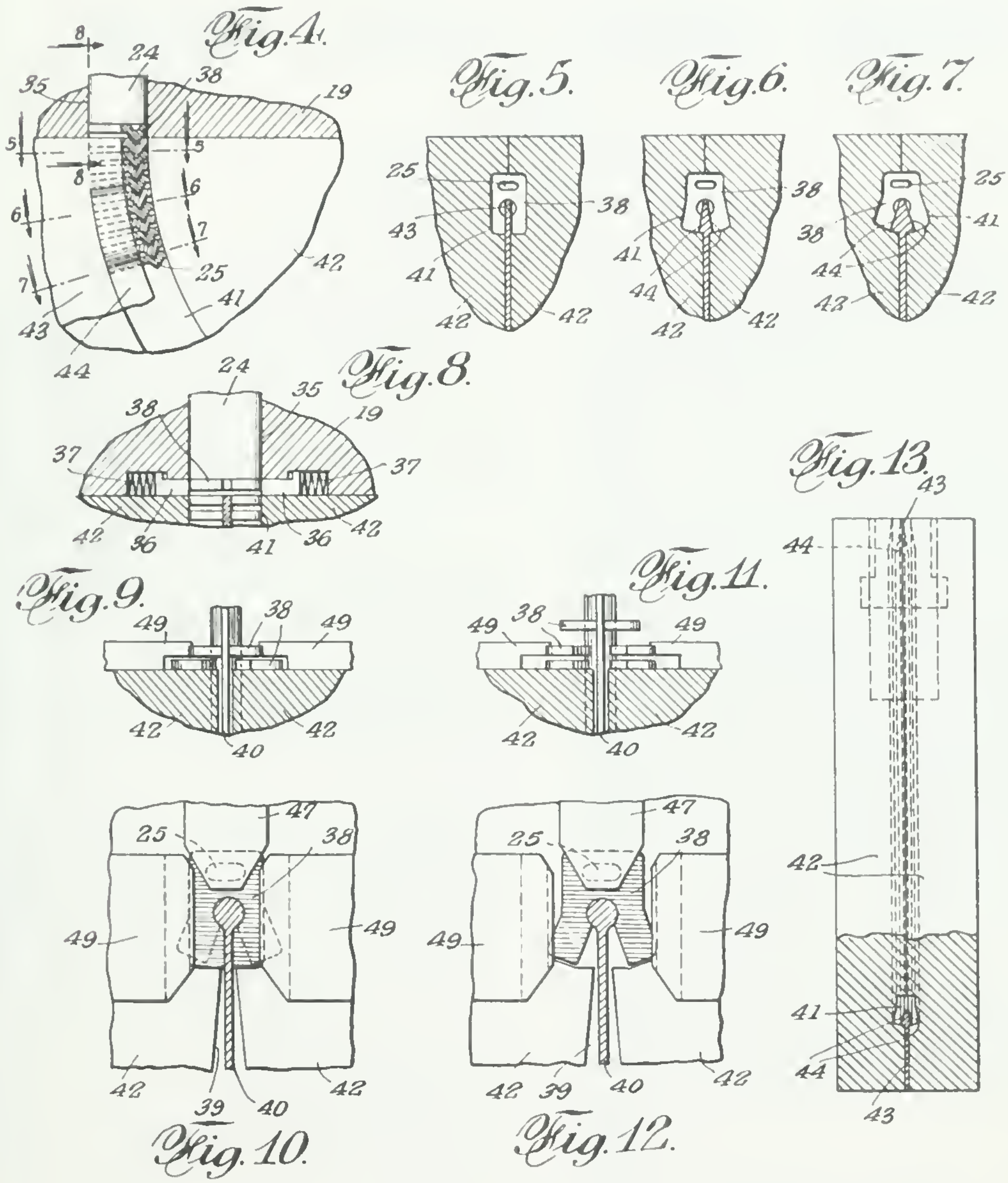

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2,294,253

FASTENING MACHINE

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Application March 23, 1940, Serial No. 325,617

9 Claims. (Cl. 153—1)

The present invention relates to the automatic production of slide fasteners and pertains more particularly to a machine and method for forming the fastener elements and for assembling them upon a tape.

The invention is characterized by its simplicity, production economy, and efficiency of operation, entailing the production of the fastener elements from a strip of metal and the guiding of the same to the point of application to a tape upon which they are fastened.

It is an object of the invention to provide apparatus whereby the elements produced thereby are directed to the point where they are applied to the tape by displacement of said elements successively in a guide track. More simply stated the invention contemplates apparatus having a guide track for receiving the elements as they are formed at one end of said track to cause displacement of the elements at the other end of said track, and at the latter point to be affixed to a tape.

In order to use a strip of metal of the narrowest commensurate width for the purposes of economy, the invention further contemplates forming the elements in the shape and form which they assume on the tape, providing means in the guide track for spreading the elements so they may be readily associated with the tape and then restoring the elements to their initial shape as they are clamped upon the tape.

The invention also contemplates novel means for clamping the elements upon the tape and includes, among other novel features, the provision of means for stripping the elements from the element forming punch, and the provision of means for chopping up the scrap of the strip from which the elements are formed and disposing of the same.

The foregoing and other objects, features and advantages of the invention will be more clearly evident from the following detailed specification describing the invention.

The accompanying drawings, forming the basis for the specification, illustrate, in an exemplary manner, a machine incorporating the inventive concept and by means of which the present novel method may be practiced.

In the drawings:

Fig. 1 is a top plan view of a machine incorporating the features of the invention, the ram thereof being omitted and the punch members thereof being shown in cross-section;

Fig. 2 is a vertical sectional view as taken on line 2—2 of Fig. 1;

Fig. 3 is a plan view of a strip showing its condition as moving through the machine;

Fig. 4 is a fragmentary detail vertical sectional view showing the entering end of the fastener element guide track;

Figs. 5, 6 and 7 are respectively detail sectional views as taken on lines 5—5, 6—6 and 7—7 of Fig. 4;

Fig. 8 is a fragmentary cross-sectional view as taken in the plane of line 8—8 of Fig. 4;

Figs. 9 and 11 are fragmentary detail sectional views of the exit end of the guide track and showing respective stages of operation;

Figs. 10 and 12 are fragmentary plan views of Figs. 9 and 11, respectively;

Fig. 13 is a vertical cross-sectional view of the track members showing the guide track therein.

In the preferred embodiment of the invention which is illustrated, the drives for the various operating portions of the machine have been omitted in-as-much as these drives may be conventional and are not necessary for understanding the structure and mode of operation.

The machine is preferably arranged upon a horizontal support 15 from which the vertical pilot studs 16 project upwardly to hold the guide 17 for the ram or punch 18. The latter may be reciprocated in the usual manner as by one revolution clutch means.

Upon the support 15 there are arranged members 19 which form a guide for a metal strip 20 from which the fastener elements are punched. This strip may be intermittently fed through said guide in uniform increments as by means of the feed rolls 21 in timed synchronous relation with the movement of the punch in any well-known manner.

As illustrated in Figs. 1, 2 and 3 the ram 18 is preferably provided with a tool 22 for forming the prong of the fastener element; with a tool 23 for punching out the slit of said element; and with a tool 24 for severing the element from said strip. It will be noted that the operations performed by these three tools are simultaneous so that with each operation of the punch and with a commensurate feed of the metal strip 20, a fastener element is formed although three stages of operation have been employed to form said element. In order to accommodate the prong 25 after formation by the tool 22 the lower of the members 19 is recessed as at 26 so that feed of the strip 20 is not interferred with. The punching 27 which leaves the slit in the element may fall away as through a passage 28 formed in the support 15.

As seen in Fig. 3, when the elements have been severed from the strip, said strip is disposed of by chopping up the scrap as by means of a knife 29 having shearing engagement with the edge 30 of the lower member 19. These chopped pieces 31 of the strip are disposed of by means of an air jet 32 which blows them into a disposal passage 33 confined by the walls 34.

The punching tool 24 operates within a cavity 35 formed in the lower of the members 19. Inasmuch as it is necessary to strip the element away from said punch so as not to be pulled upward thereby during the recovery movement of the ram, means are provided as shown in Fig. 8 for frictionally engaging edge portions of the element to hold the same while the punch retracts.

As illustrated, this means preferably comprises the detents 36 urged, as by means of the springs 37, inwardly toward each other to clamp the element 38 therebetween. With each operation of the punch a new element is formed and serves to displace the preceding element as it becomes positioned between the detents 36.

The machine is provided with a passage 39 through which is intermittently moved a tape 40 upon which the elements 38 are to be mounted. Although not illustrated any suitable manner of moving the tape in the direction of the arrow and in an intermittent manner may be employed.

It is desired to transfer the elements 38 from their position beneath the punch 24 to an associated position with the tape 40 so that said elements may be clamped to said tape. In the present instance the means employed for this purpose preferably comprises an arcuate substantially semi-circular guide track 41 which is formed within the adjacent blocks 42 held in fixed supported relation on support 15.

It is evident from the above that as an element is formed by the punch 24 and urged thereby to a position between the detents 36, displacement of all of the elements forming a column and being in contact with one another within the guide track 41 occurs.

Thus, as a new element is formed, the element of the said column nearest the exit of the guide track is projected upwardly out of said guide track. This mode of feed occurs successively with each reciprocation of the ram 18.

In order to obviate accidental dearrangement of the elements within the guide track 41 it is preferred to position a stringer 43 within said track and having cooperative association with the slots formed in the elements 38.

Although the elements may be punched from the strip 20 in a spread condition so as to be ready for association with the tape and particularly with the bead thereof, it is preferred to form said elements in their closed or contracted condition so that a narrower strip 20 may be employed to effect a saving in the cost thereof. Since in their contracted condition the elements cannot be mounted upon the tape, it becomes necessary to spread them. For this purpose the stringer 43, at any desired portion of the guide track 41, is formed with the opposed cam surfaces 44. It is readily apparent that, as the elements progress in close contact with one another through the guide track, these cam surfaces wedge the elements apart from the condition shown in Fig. 5 to that shown in Fig. 7 where they are in tape mounting condition. The guide track, of course, is designed to accommodate the spreading of the elements.

In order to control and definitely position the element which is being displaced from the guide track, a member 45 acted upon by a cam 46 carried by the ram, is moved to overstanding relation to said element and thus serves as a stop therefor. A finger 47 on the member 46 serves this purpose. When the ram is retracted, means, such as a spring 48, serves to move the finger 47 out of the mentioned overstanding relation with the ejected element.

While the ejected element is held as above described, it is clamped to the tape 40 as by means of clamp members 49. This condition is shown in Figs. 9 and 10. After the clamping action has occurred the finger 47 and the clamping members 49 are moved from engaging relation with the clamped element so that the tape 40 may be fed as hereinbefore indicated. After this movement of the tape the finger 47 is again moved to overstanding position with respect to the next ejected element and subsequently thereafter the clamping members 49 are operated to clamp said next element to the tape. In this manner the elements moved through the guide track are successively clamped to the tape 40.

The clamping members 49 may be operated in any suitable manner. For instance, they may be mounted upon slides 50 movable by cam means 51 through the medium of levers 52, the springs 53 serving to retract the clamping members, whereas the cam means 51 serve to control them during their clamping movement.

It will be particularly noted that no moving parts have been employed to effect the transfer of the elements from the punch to the tape, the transfer being effected by successive and progressive displacement of the elements as they are being formed. It is evident then that a particular characteristic of the machine is its simplicity and that its efficiency is high inasmuch as there is little likelihood of disarrangement of the operating parts.

While the machine has been described in considerable detail and with respect to an embodiment thereof which is at present preferred, it should be understood that the principles disclosed herein may as readily be practiced in embodiments thereof which may vary in detail from that disclosed.

It is intended, therefore, that the spirit and scope of the invention as claimed be not unduly limited by the present disclosure.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent, is:

1. A machine of the character described comprising means for forming fastener elements, said means including a punch for severing said elements from a strip of metal fed to said machine, means for stripping the elements from said punch comprising spring urged members arranged in spaced opposed relation and having frictional engagement with opposite lateral portions of said elements, track means for guiding said elements to a tape for mounting thereon, said elements contacting each other in said track means and being progressively displaced by at least one succeeding element severed by said punch to move another of said elements out of said track, and means for clamping each element to said tape as it leaves the track.

2. In a machine of the character described guide means for fastener elements, means for

moving said elements, said guide means comprising a curved channeled track, and means projecting into said track for gradually spreading the elements into tape associating condition during movement thereof along said track.

3. In a machine of the character described means for receiving fastener elements and guiding the same to a tape, means for moving said elements in said first mentioned means and means provided with opposed cam surfaces fixedly disposed within the first mentioned means for gradually spreading the elements into tape associating condition during movement thereof in said first mentioned means.

4. A machine of the character described comprising means for feeding fastener elements, guide means for receiving and directing said elements from said feeding means and provided with an inlet and an outlet, the respective contours of said inlet and said outlet being disposed in opposed direction, and a tape adapted to be intermittently moved and to which said elements are to be attached, said tape being positioned adjacent said outlet, said elements being fed through said inlet into said guide means and being movable therealong by succeeding elements fed by said feeding means whereby an element discharged from said guide means at said outlet is presented in proper associative relation with said tape and moved in the direction of the movement of the tape for engagement with said tape.

5. In a machine of the character described having means for feeding fastener elements and a tape adapted to be intermittently moved for mounting thereon fed fastener elements in spaced apart relation; said feeding means comprising guide means positioned adjacent said tape, said guide means being provided with an inlet and an outlet and being adapted to receive therein a column of fastener elements successively arranged and extending in contact with one another from said inlet to said outlet, and means provided with opposed cam surfaces projecting in said guide means for gradually spreading said elements into tape associating condition, whereby upon feeding an element through said inlet to said column said column will be displaced in such manner that an element thereof positioned adjacent said outlet is moved in the direction of said intermittently moved tape for engagement with said tape.

6. In a machine of the character described having means for feeding fastener elements to a tape to be intermittently moved for mounting thereon said fastener elements in spaced apart relation; said means comprising curved guide means for said fastener elements, said guide means being provided with an inlet and an outlet and being adapted to receive a column of fastener elements therein extending successively and in contact with one another from said inlet to said outlet, the outlet of said curved guide means being positioned in such manner with respect to said inlet as to present elements adjacent said inlet and adjacent said outlet in opposed positions, an element adjacent said outlet astriding said tape for engagement with the tape upon feeding an element to said column through said inlet whereby said column is displaced.

7. The method of producing element bearing fastener tapes which consists in severing the elements successively from a strip of metal, each element having the shape and contour which it assumes when mounted on a tape, feeding said elements singly into a guide chute so that each element displaces the preceding element in contact therewith, whereby the elements are successively moved out of said guide chute, gradually spreading the elements into tape associating condition during their movement through said chute, and clamping each spread element to the fastener tape as said element comes out of said chute.

8. In the herein disclosed method, the step of displacing a stack of fastener elements transversely disposed in curved guide means as each element is formed and joins said stack, and the further step of gradually spreading the elements of said stack during their displacement lengthwise and out of said guide means from contracted to tape associating condition.

9. In a machine of the character described, stamping means for forming fastener elements, means for clamping the fastener elements on a tape, means for feeding the fastener elements from the forming means to the clamping means, said feeding means comprising a tubular guide having a passage corresponding to the shape of the fastener elements and interconnecting the stamping means and clamping means, said guide being slitted at a location adjacent said clamping means to bring the tape into contact with fastener elements at said location.

FRED R. TABERLET.

DEFENDANT'S EXHIBIT "L"

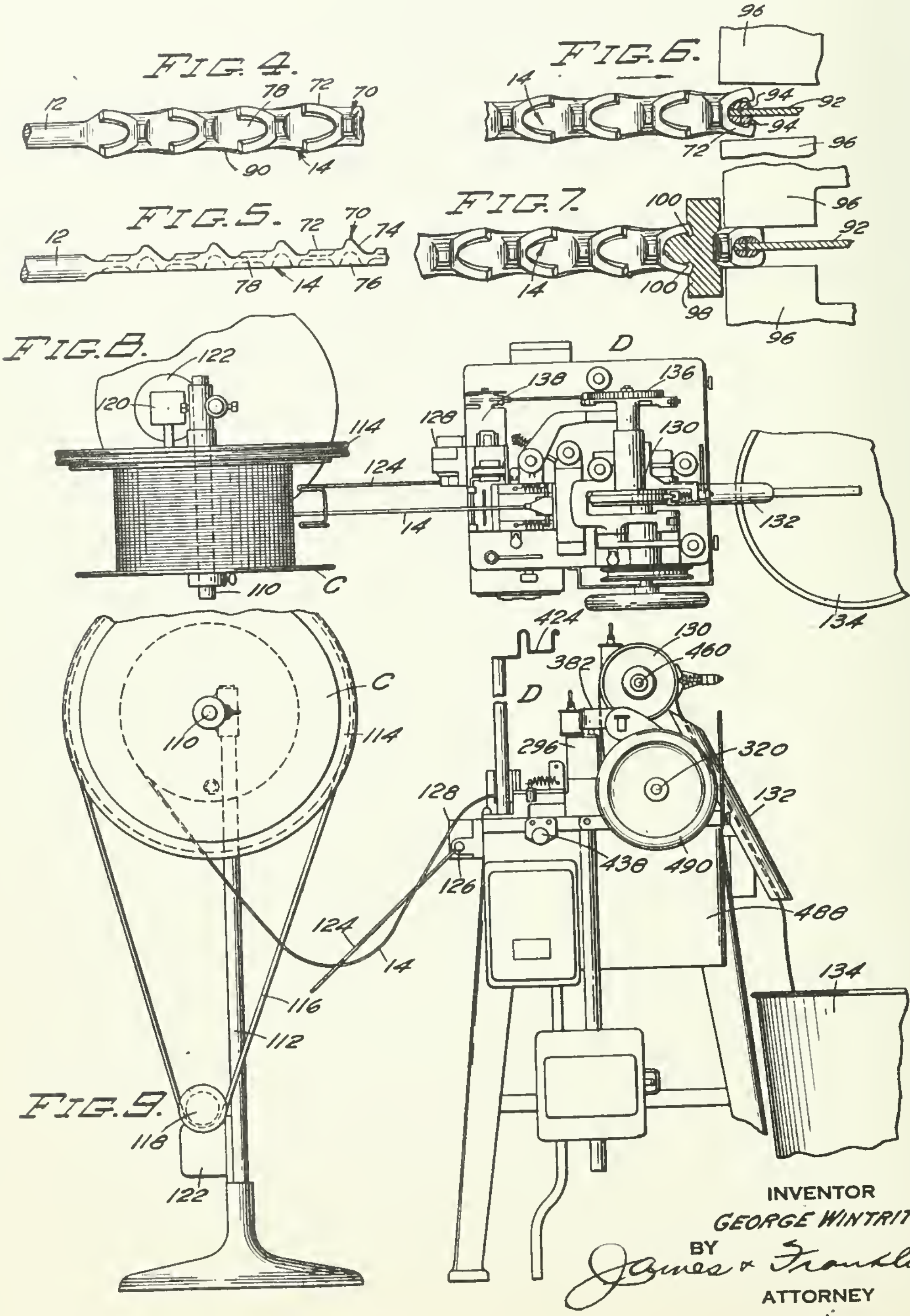
G. Wintritz Patent No. 2,201,068

Filed June 22, 1938 Patented May 14, 1940

May 14, 1940. G. WINTRITZ 2,201,068

MANUFACTURE OF SLIDE FASTENERS

Filed June 22, 1938 7 Sheets-Sheet 2



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MANUFACTURE OF SLIDE FASTENERS

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FIG. 10.

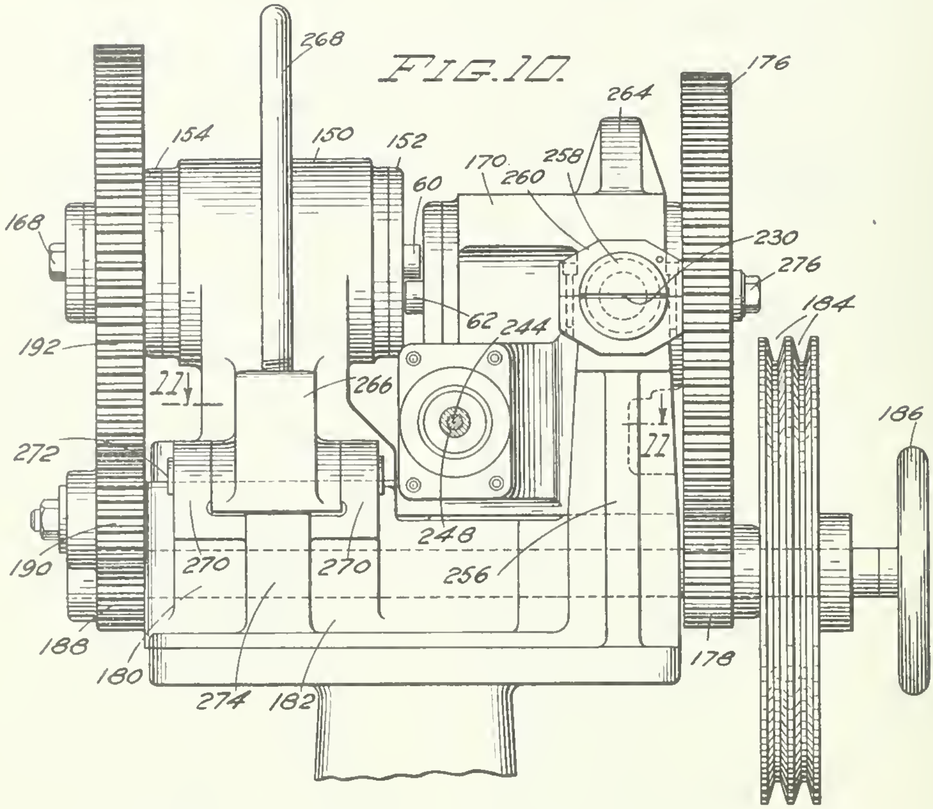


FIG. 11.

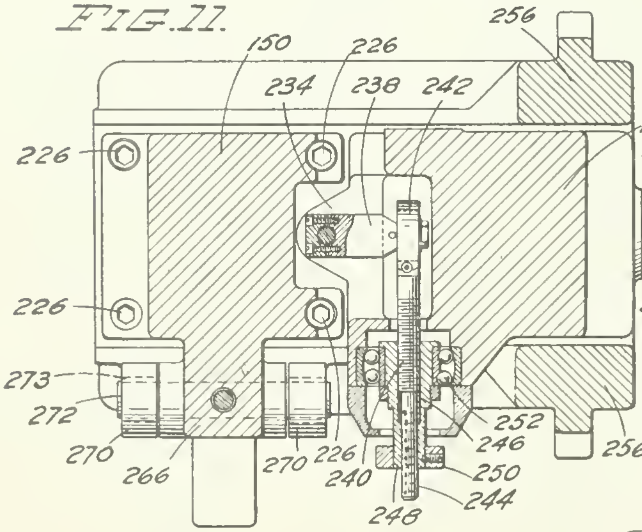
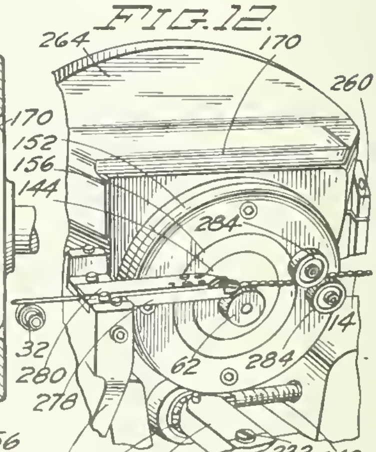


FIG. 12.



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MANUFACTURE OF SLIDE FASTENERS

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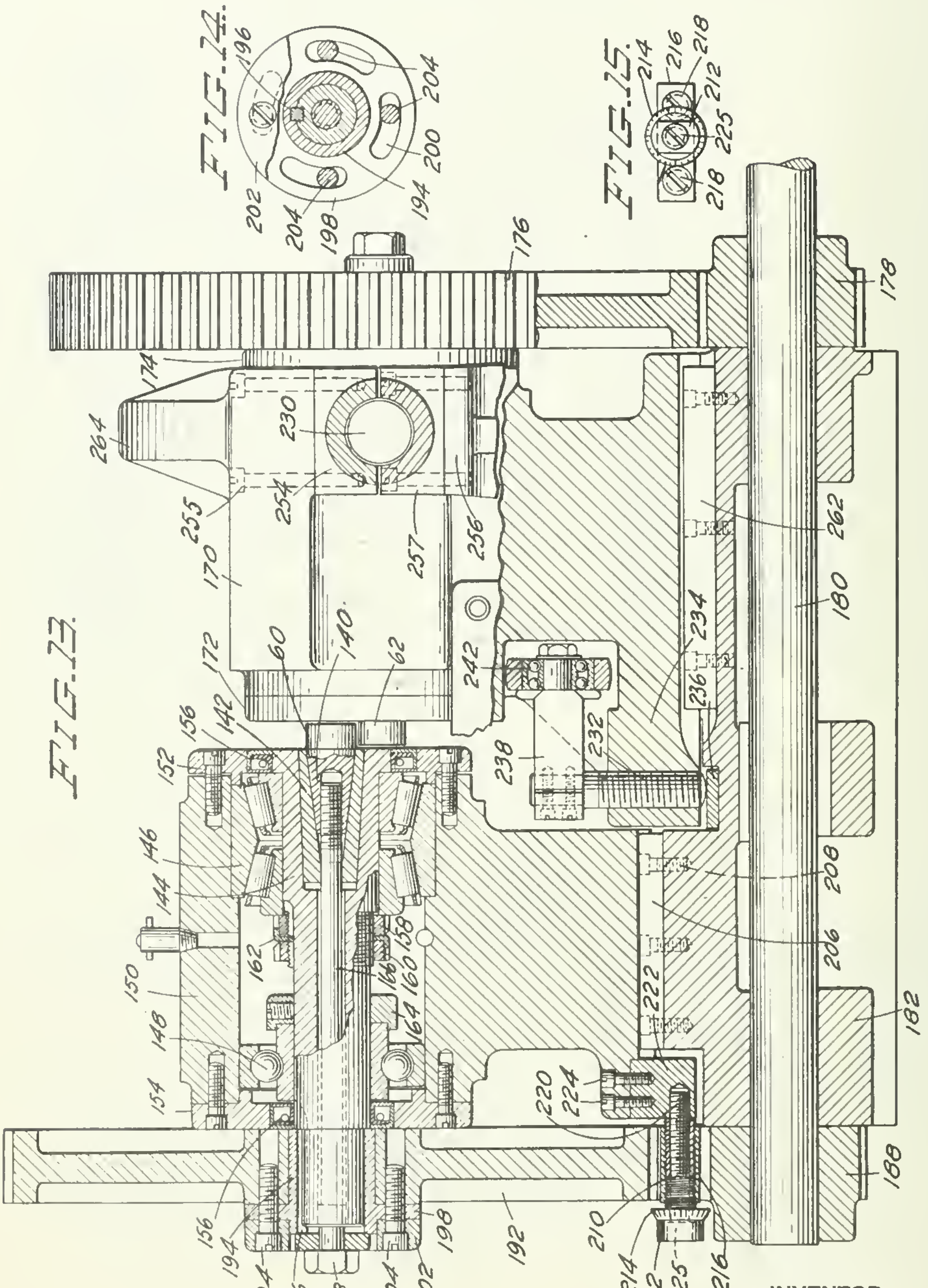

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MANUFACTURE OF SLIDE FASTENERS

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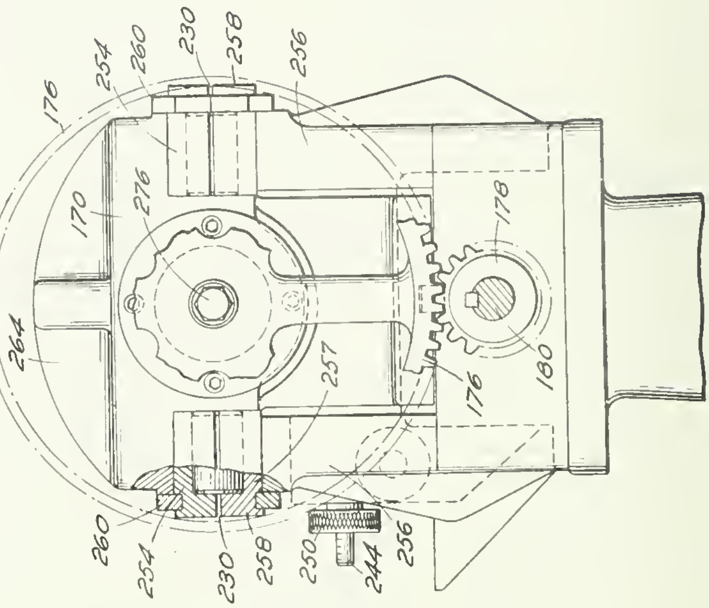

FIG. 17.

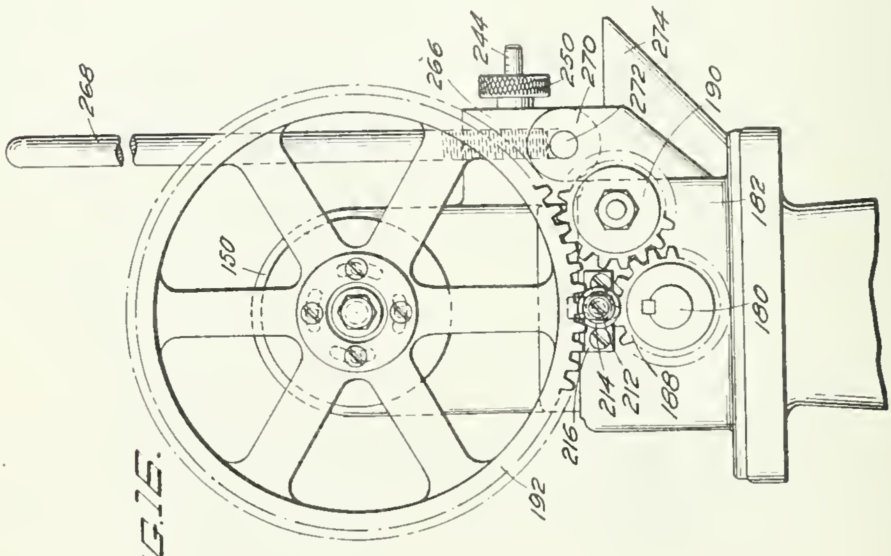

FIG. 16.

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FIG. 18.

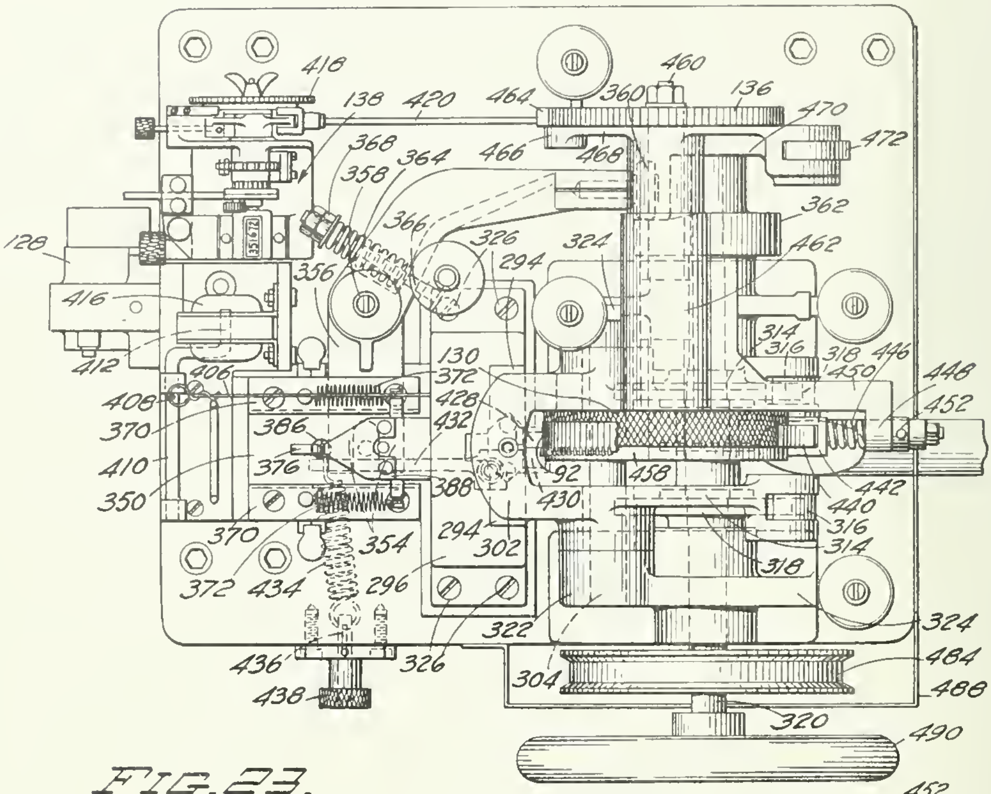


FIG. 23.

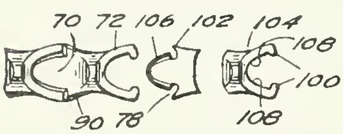
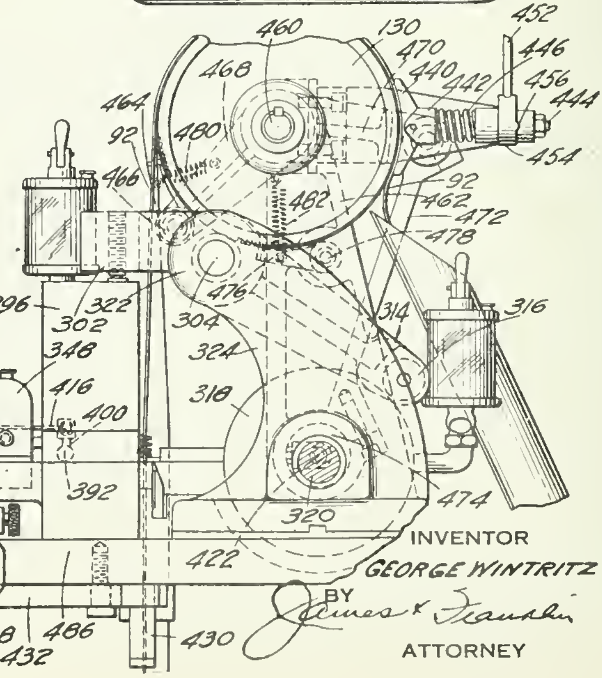


FIG. 19.



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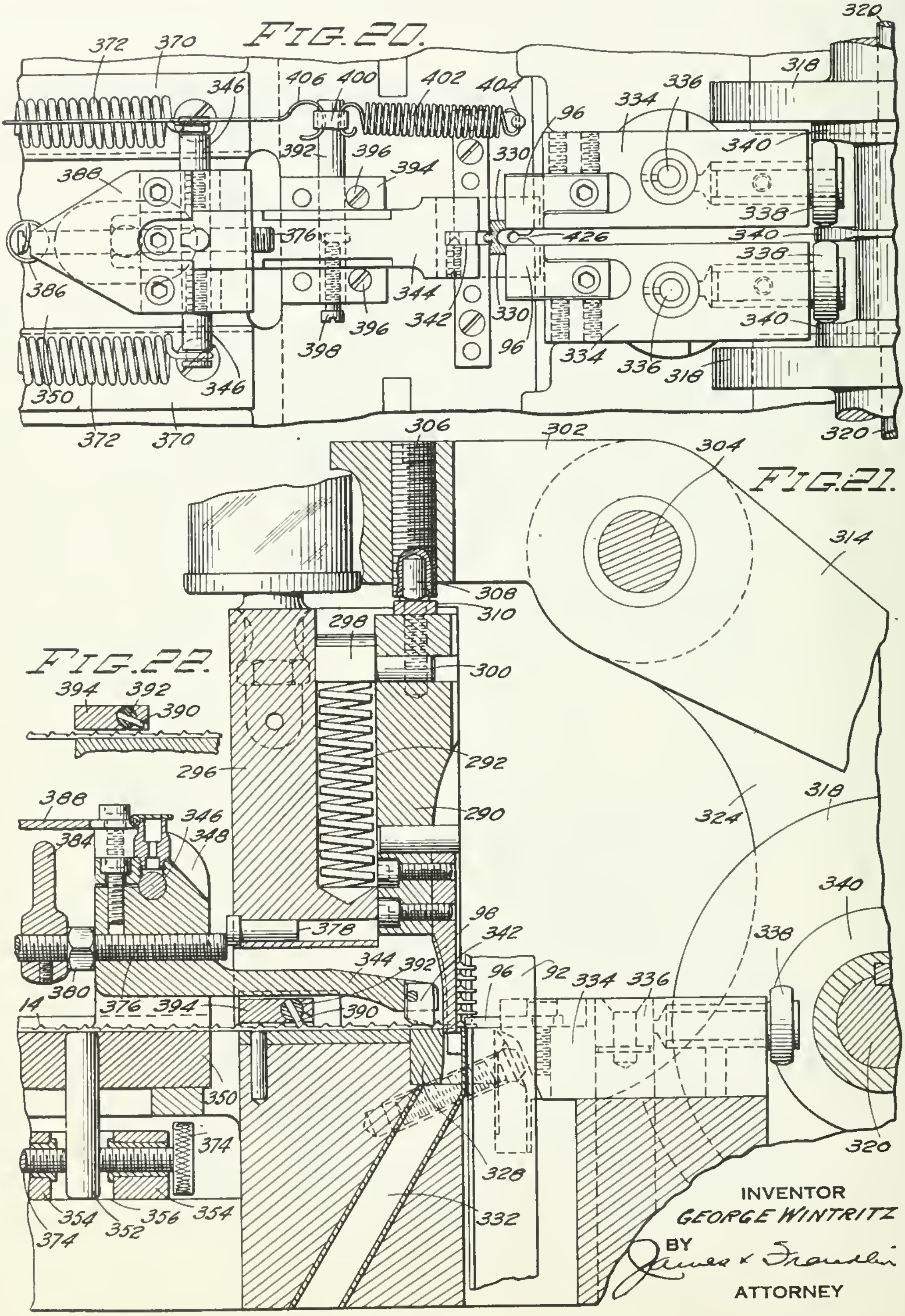

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Disclaimer

2,201,068.—*George Wintritz*, Staten Island, N. Y. MANUFACTURE OF SLIDE FASTENERS. Patent dated May 14, 1940. Disclaimer filed Mar. 8, 1949, by the assignee, *Conmar Products Corporation.*

Hereby enters this disclaimer to claims 43, 44, 45, 47, 48, 49, 50, 51, and 52 of said patent.

[*Official Gazette April 19, 1949.*]

UNITED STATES PATENT OFFICE

2,201,068

MANUFACTURE OF SLIDE FASTENERS

George Wintritz, Staten Island, N. Y., assignor to Conmar Products Corporation, Bayonne, N. J., a corporation of New Jersey

Application June 22, 1938, Serial No. 215,180

54 Claims. (Cl. 153—1)

This invention relates to the manufacture of slide fasteners.

The primary object of my invention is to generally improve the manufacture of slide fasteners, and more particularly, to simplify, cheapen, and speed up the manufacture of the same.

Practical commercially-used methods of making slide fasteners may be generally sub-divided into methods using two machines, the elements being made in one machine and mounted on the tape by another; and methods using a single machine in which the elements are both manufactured and attached to the tape. With two machines it has heretofore been necessary to hopper the loose elements in order to arrange the same in uniform position. This difficulty is avoided when the elements are made and attached in a single machine, but then the apparatus is less flexible for meeting varied commercial requirements. This is so because with two machines it is possible to manufacture and store up a supply of elements and to later mount the same on tapes in accordance with orders received, thus accommodating requirements which vary from day to day as regards stringer length, tape color, tape quality, and so on. At the same time, the manufacture of the elements in the first machine is facilitated because the machine may be run at best speed for making the elements without regard to the speed at which the elements may be mounted on the tape, and the tools for making the elements may be replaced or sharpened or repaired whenever necessary, without interfering with the operation of the second machine. Moreover the first machine may operate continuously, without the numerous interruptions which occur in the second machine, particularly for spacing between stringers.

One object of my invention is to overcome the disadvantages of both the single and double machine systems of the prior art, while retaining the advantages of each. For this purpose, I form a connected series of embryo elements from wire or like continuous stock. The embryo elements themselves form a continuous wire, and this "element wire" is a true step product which is reeled and stored in lengths of a mile or more. The reel may be unreeled and fed to a separate machine for merely severing the elements and attaching the same to the tape. In this way, the advantages of using two machines may be obtained without necessitating handling and hoppering of loose elements.

Still another object of my invention is to make possible the use of simple round wire stock, thus minimizing the cost of the raw material, and a further object is to reduce the amount of scrap or waste of stock. Both of these factors contribute to lower the cost of manufacture of the slide fastener.

A further object of my invention is to obtain elements of uniform pitch, despite variations in the diameter, hardness, and "flowability" or ordinary commercial round wire stock. The round wire stock is not merely punched, but is pressed and deformed into a wholly new shape. If these elements are formed by successive reciprocations of a press, the speed of operation is slow, and an even more important difficulty arises because of irregularity in the pitch of the elements. It is very difficult to obtain uniform feed of the wire, and changes in pitch occur even with a uniform feed, because during its extensive deformation the material undergoes a substantial stretch or elongation, but this elongation may vary due to changes in either the diameter or hardness of the original round wire. This results in changes in the pitch or/and length of the elements, and such changes produce irregularities in the slide fastener which spoil the desired smooth, sliding action of the slider, and in extreme cases, may altogether prevent operation.

One primary object of my invention is to overcome this difficulty and to produce an element wire of uniform pitch. A further object of my invention is to greatly increase the speed of manufacture of the embryo fastener elements. These objects I fulfill by pressing and deforming the smooth round wire into the desired series of embryo elements by running the wire between rapidly rotating pressure rolls which are shaped negatively to the desired configuration of the embryo fastener elements. The wire is rolled to desired shape in a single passage through a special form of rolling mill. The rolling process insures uniform pitch, and any variations in hardness and diameter of the original wire manifest themselves as changes in the cross section rather than changes in the length of the elements in the rolled wire.

The embryo elements are formed with spread or divergent jaws. In accordance with my invention as applied to the specific form of fastener element disclosed herein, the jaws are unconfined at the outside, thus accommodating the changes in wire section. Moreover, there is the advantage of leaving the outside of the jaws in smooth, unmarred, and rounded shape. However, it is convenient to have the over-all or maximum breadth of the element wire constant, and to accomplish this is still another object of my invention. This is done by leaving the jaws unconfined except at the side where they are furthest apart. Ample room is provided in the roll for flow of excess metal, and changes in cross section occur, but the maximum width, at the side of the jaws, is held within a desired tolerance.

The shape of the element wire is complex, and the impressions to be formed therein are relatively deep. Moreover, the necessary mutilation of the wire is so great that the wire is greatly elongated as it is pressed to shape, this elongation being, say, one-third, for the specific form of element wire disclosed herein, that is, the length of a reel of this specific element wire is approximately one-third greater than the length of the reel of uniform wire from which it was made. It is therefore difficult to obtain clean accurate shaping of the wire when rolling the same. I have found that the desired result may be attained by using pressure rolls of very small diameter. More specifically, the pressure rolls should be less than two inches in diameter, and I prefer and recommend rolls which are only about one inch in diameter.

While this may be considered an empirical discovery without regard to theory, I believe that one main advantage of the small diameter rolls is in order to avoid confinement of more than a very few elements at one time, thereby avoiding difficulty arising from the elongation of the wire being rolled, which otherwise puts such a strain on the impressions in the rolls that they tend to crack and break. Furthermore, the small roll may be operated with less force because it contacts with only a small length of wire at one time, and this is important when seeking a high unit pressure for the substantial deformation needed to produce the embryo slide fastener elements.

The operation requires the use of exceedingly high pressure on the rolls, and further requires the application of a powerful torque for rotating the rolls. It is therefore important to employ shafts, bearings, and gears which are all massive in size, and sturdy in construction, these parts being very much larger than the relatively tiny hardened pressure rolls which, as previously explained, are preferably only about one inch in diameter. It is acordingly a further object of my invention to reconcile these conflicting requirements and to provide a suitable machine particularly adapted for the rolling of the element wire.

I have already mentioned speed of manufacture as a general object. It will be understood that by this rolling process, the embryo elements may be made at very high speed despite the fact that the rolling mill is the heavy duty part of the apparatus. The attaching machine is a light duty machine, for it need merely sever and attach the elements to the tape and may therefore be run at high speed. I have developed a comparatively small and inexpensive machine for this purpose which may be run at a speed more than double the speed heretofore posible in slide fastener manufacture. Even greater improvement in speed is obtained in the rolling mill, and in actual plant operation the element wire for four or five attaching machines is readily supplied from a single rolling mill.

In the specific form of element wire here disclosed the space between the spread jaws and extending to the head of the next embryo element is filled with metal which is subsequently punched out in the attaching machine. In accordance with a feature and object of my invention, much of this metal is made comparatively thin to reduce waste. Moreover, a thin web makes possible a desired slope at the end of the head, so as to produce a triangular rather than rectangular profile.

Further objects of my invention center about the rolling machine, and are to provide axial and rotational adjustment of one of the pressure rolls relative to the other in order to obtain registration of the rolls, and to obtain a micrometric precision adjustment of the spacing between the rolls so that this spacing may be varied slightly when necessary or desirable because of substantial change in the dimension or character of the round wire stock. Another object is to provide means facilitating movement of one of the main bearing housings out of the way of the other, thereby clearing each of the rolls from the opposite bearing in order to make it possible to remove the rolls.

Still further objects of my invention center about the attaching machine, and one such object is to provide a loop of slack wire between the heavy reel of wire and the feed means of the attaching machine, said slack being maintained between desired limits by a suitable intermittently operated motor for unwinding the reel. Other objects are simplicity and high speed, for which purposes I operate a severing punch, clamping jaws, wire feed means and tape feed means all from a single main cam shaft, while keeping said reciprocating parts small and light and short in stroke. Another object is to provide a feed dog which engages the wire at a point just ahead of and very close to the severing punch. Another object is to interrupt the feed of the element wire to the tape when providing a blank space of tape between stringers, and this is done by means of a counter controlling a solenoid, in the specific case here illustrated, which elevates a check dog associated with the feed dog for the element wire. Still another object is to bring the inside of the spread jaws of the elements to desired shape after they have been only roughly shaped by the rolling mill, and this is done by means of the severing punch. This, in the specific case here illustrated cuts away the web of waste metal between elements, said punch being so shaped as to also cut away some of the metal inside of the jaws, in addition to the web, and thereby bring the jaws to the desired shape.

To the accomplishment of the foregoing and other objects which will hereinafter appear, my invention consists in the method steps and apparatus elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 illustrates the rolling mill and associated apparatus for deforming wire stock into the desired series of elements;

Fig. 2 is an elevation of the same;

Fig. 3 is a section through the pressure rolls and is explanatory of the operation of the same;

Fig. 4 is a plan view of a piece of round wire stock showing the manner in which it is deformed to produce the embryo elements;

Fig. 5 is a side elevation of the same;

Fig. 6 schematically illustrates a preliminary step in the finishing and attaching of an element;

Fig. 7 illustrates the final steps in the finishing and attaching of an element;

Fig. 8 is a plan view of the attaching machine;

Fig. 9 is an elevation of the same;

Fig. 10 is a partially sectioned elevation of the rolling mill;

Fig. 11 is a horizontal section taken in the plane of the line 11—11 of Fig. 10;

Fig. 12 illustrates the lower pressure roll and bearing as seen when the upper bearing is tilted out of the way;

Fig. 13 is a partially sectioned side elevation of the rolling mill;

Fig. 14 is explanatory of the rotative adjustment of the rolls;

Fig. 15 is explanatory of the axial adjustment of the rolls;

Fig. 16 is an end elevation of the rolling mill;

Fig. 17 is a partially sectioned elevation of the opposite end of the rolling mill;

Fig. 18 is a plan view of the attaching machine;

Fig. 19 is a side elevation of the same;

Fig. 20 shows a part of the attaching machine in plan to enlarged scale;

Fig. 21 is a section taken in elevation through a part of the attaching machine drawn to enlarged scale;

Fig. 22 is a detail of the feed check dog;

Fig. 23 illustrates the scrap or waste which is punched away during finishing and attaching of the elements to the tape;

Fig. 24 is explanatory of the design of the female roll, and

Fig. 25 is a section on the line 25—25 of Fig. 24.

Referring to the drawings, and more particularly to Figs. 1 through 9, a reel A of uniform wire is fed through a special form of rolling mill B which deforms the wire into a connected series of embryo elements, which may for brevity be referred to as "element wire." This element wire is wound up on a take-up reel C. The pressing of the wire in the rolling mill is schematically shown in Fig. 3. The nature of the change produced in the wire, that is, its conversion from a simple round wire 12 into the element wire 14, is illustrated in Figs. 4 and 5. The reel C of element wire may be stored away until needed, and when needed, is mounted in front of an attaching machine D, as is clearly shown in Figs. 8 and 9. This machine completes the elements and attaches the same in properly spaced relation along the edge of a tape.

Considering the method of the invention in somewhat greater detail, and referring first to Figs. 1 and 2, a reel of ordinary commercial wire stock is placed on a rotatable table 16 carried on a stand 18. The wire is preferably ordinary round wire and is therefore inexpensive compared to stock of special cross-section. The reel is centered on the table by guides 20, and is held in original compact condition by spokes 22 adjustably mounted on guides 20. The radial position of the guides is adjustable in slots 24 and is maintained by clamps 26. It may be mentioned that when the reels of wire are purchased on wooden reels, the wire may be unwound directly from the wooden reels, and in such case it is not necessary to mount the reel on a vertical axis, it being more simply mounted on a horizontal axis.

The wire next passes through a lubricating station 28 and then through horizontal and vertical sets of straightening rolls 30 and 32. The wire then passes between the pressure or forming rolls. For reasons explained in greater detail hereinafter, these rolls are relatively tiny, having a diameter of, say, one inch, but they are pressed against the wire with such a high pressure that they are mounted in massive shafts having a diameter far greater than that of the rolls themselves. These shafts are carried in massive bearings 34 and 36 which extend in opposite directions away from the rolls. The shafts are geared together through an appropriate countershaft and heavy gearing, the gearing being concealed in Figs. 1 and 2, by guards 35 and 37, but exposed in Figs. 10 through 17 of the drawings. The rolling mill is driven by a motor 38. The formed wire leaving the mill is wound up on reel C, this being rotated by a pulley 40 driven through belt 42 by a motor 44. The element wire is moved slowly back and forth over the surface of the reel C in order to wind the wire up in smooth successive layers. This is done by means of a two-way screw 46 which reciprocates a nut 48 back and forth, said nut carrying a guide for the element wire. Screw 46 is driven by a pulley 50 which in turn is operated through belt 52 by means of a pulley 54 mounted on the shaft 56 carrying the reel C and pulley 40 previously referred to. Shaft 56 and feed screw 46 are both carried on a suitable stand 58.

Referring to Fig. 3, the upper pressure roll 60 is formed negatively to one side of the element wire 14, while the lower pressure roll 62 is formed negatively to the other side. The pitch diameters of both rolls are equal, but in the specific case here illustrated the apparent diameters differ, this being so because I treat the upper roll 60 as a female roll having depressions formed therein, and I treat the lower roll 62 as a male roll having protuberances projecting therefrom. In respect to the operation upon the wire, however, the rolls may be considered to be and are equal in diameter and are therefore rotated at equal rotative speeds to produce equal linear speeds. It will be understood that when there are apparently unequal diameters, as here shown, there is preferably a little clearance between the peripheries 64 and 66 of the rolls, so that they do not actually engage one another in rolling contact.

Referring now to Figs. 4 and 5, the embryo elements comprise an embryo head portion 70 and spread or divergent embryo jaws 72. The head portion 70 is conventional in comprising a projection 74 and a recess 76. The embryo elements all point in one direction and this direction is head first when leaving the rolling mill, so that the embryo elements are wound up on the reel pointing head first. The main reason for this is so that they will be unwound pointing jaws first, this being of particular convenience in connection with the operation of the attaching machine, as will be subsequently described. The embryo jaws of one embryo element are connected to the embryo head of the next embryo element, and in the specific case here illustrated the connection is by means of a web of metal 78. The web is made relatively thin in order to minimize the amount of waste stock produced when finishing and serving the elements.

The metal is not truly confined at the outsides of the embryo jaws, and no fin is produced at this point. Referring to Fig. 24, I show a development of the female roll, and may emphasize the existence of spaces 80 and 82 outside the element strip 84 (only the outline of which is shown). I have made and successfully used many rolls in which the outside of the cavity is intentionally disposed at great width, as is indicated by the broken line outline 86. In such case, there is obviously no confinement whatsoever at the outside of the jaws of the elements as they pass through the rolling mill, and any variation in diameter or hardness or flowability of the wire (for the wire may vary in flowability even while showing the same apparent hardness by Rockwell test, due to differences in the annealing treatments when drawing the wire) is taken up by a change in breadth of the element wire, there being no substantial change in pitch or element length. With the side wall of the cavity defined by line 88 instead of line 86, substantially the same result is obtained, for there is ample space in which excess metal may flow, as is shown in plan at 80 and 82 in Fig. 24, and as shown in section at 81 and 83 in Fig. 25. Fig. 25 also shows how the outside walls of the jaws are left with a rounded surface, resulting in a smooth-feeling and easy sliding fastener.

The advantage of producing a slight confining effect at the outside of the jaws, as by means of the wall 88, is that the outside or maximum width of the element wire is maintained constant, and this is of convenience when subsequently handling the wire in the attaching machine, in order that the wire may be fed between and accurately guided by suitable guides engaging the side edges of the element wire. The slight confinement produced by the straight walls 88 is not sufficient to materially mold or change the configuration at the outside of the jaws, and is not such as will produce a fin, the jaws being left as smooth and unmarred by fin as when using rolls having the widely spaced walls 86.

The metal is confined, however, at the heads 70, and this produces a slight fin indicated by the broken line at 90 in Fig. 24. The fin is also indicated at 90 in Fig. 4. The presence of this fin depends upon the diameter, etc. of the wire, and is of no great consequence because it is thin, and readily bent over when the completed slide fastener is run through calibrating rolls which are customarily used in this art somewhere near the end of the manufacturing process.

Referring now to Figs. 6 and 7, the element wire 14 is unwound from the reel with the embryo elements pointing jaws first. A tape 92 of conventional character is supported and arranged for intermittent feed movement in a direction transverse to the direction of movement of the element wire 14. The edge of tape 92 is provided with the conventional bead or cord, this being formed in the present case by stitching two cords 94 on opposite sides of the edge of the tape. The element wire is fed forwardly until the spread jaws 72 of the leading element are placed astride the edge of the tape. The apparatus is provided with clamping plates 96 for closing the jaws 72 on the tape, this step being indicated in Fig. 7. The attaching machine is also provided with a punch 98 so shaped as to cut away the waste metal between the elements and thus sever the endmost element from the remainder of the element wire, as is shown in Fig. 7. After the element has been attached to the tape, the tape is moved longitudinally an amount equal to the spacing between elements. The element wire 14 is then advanced longitudinally until the next element is placed with its jaws astride the tape, as shown in Fig. 6. The element is then severed and attached, and this operation is repeated until the desired length of stringer is obtained. It will be observed that the shape of punch 98 is such as to finish shaping the jaws, including the small projections or hooks 100 at the ends of the jaws.

The embryo elements in the element wire have only embryo jaws, which are not really in finished shape. The desired configuration is too complex to be produced in a simple rolling operation. However, by causing the punch 98 to cut away not only the thin web 78, but also some of the thicker sloping wall therearound, the jaws may be brought to desired final shape. This is illustrated in Fig. 23 in which the number 102 designates a piece of waste metal or scrap struck from the element wire to form the finished element 104. It will be noted that the piece 102 has a flange of metal 106 surrounding the web 78. This results from trimming the jaws to the final configuration shown at 108 and including the hooks 100. The severing operation shapes the head end of one element and the jaws of the next succeeding element.

The severing operation and jaw closing operations are performed almost simultaneously, for the attaching machine works at very high speed. The element may be severed from the element wire before or after attaching the same to the tape. I have practiced the invention both ways and there are certain advantages attendant upon either. When the element is attached first, it may be tilted at an angle, when the punch is dull, or due to a bend in the element wire. When the element is severed first, it may be swung laterally to an improper angle due to greater strength in one of the two jaws, as when the jaws have not been cut perfectly symmetrically. This is avoided when the element is severed last, for the element is supported during the jaw closing operation by its attachment to the element wire. The timing of the punch, and the punch location in the particular apparatus here disclosed is such that the jaws are closed slightly ahead of the severing operation.

Referring now to Figs. 8 and 9, the reel C is mounted on a shaft 110 carried on a stand 112. Shaft 110 is provided with a pulley 114 and this is connected through a belt 116 to a pulley 118 driven through worm reduction gearing 120 by a small motor 122. Motor 122 functions to wind element wire 14 off reel C, thus providing a freely hanging loop of wire between the reel and the attaching machine D in order that the latter may function without any strain or resistance such as would be caused if the feed mechanism of the attaching machine had to physically turn the comparatively large, heavy reel C. No attempt is made to run the motor 122 at exactly the right speed, and this would in any event be a difficult task because the diameter of the reel changes as the wire is unwound, and the requirements of the attaching machine vary as the space between successive stringers is reached. As will be understood by those skilled in the art, the stringers are ordered in lengths specified by the user of the same, and these lengths may vary anywhere from a few inches to several feet or even yards. A waste piece of tape is desired at each end of the stringer in order to facilitate attachment of the slide fastener to the purse, luggage, clothing, or other article on which it is being used. It is customary to make the stringers on a continuous tape with spaces or interruptions between successive stringers. Ordinarily a space of two or three inches is left without fastener elements, between successive stringers, and these spaces are produced by interrupting the feed of element wire to the attaching machine.

Because of these difficulties, I maintain the desired slack or loop of element wire between the reel C and the attaching machine D by means of a feeler arm 124 which rests lightly on the element wire and the end of which is pivoted on the attaching machine at 126. It is there connected to a mercury or other suitable switch carried in housing 128, and this switch controls the operation of wind-off motor 122. The motor is set into operation whenever arm 124 rises to a desired point, and is stopped when arm 124 sinks to a desired lower limit. In this way a loop of slack wire is maintained between the upper and lower limits defined by arm 124 and its associated switch.

The attaching machine will be described in greater detail hereinafter, but at this point it may be briefly pointed out that the tape rises vertically past the attaching station and is turned about a feed drum 130 from which the finished stringer is led downwardly through tube 132 into a basket 134. The drum 130 acts as a feed means for the tape and is itself intermittently turned by a ratchet wheel 136 operated on by a suitable feed dog. The stringer length is determined by a suitable counter 138, and at appropriate intervals determined by the counter 138, the feed of the element wire is interrupted, while the feed of the tape proceeds as before, thus producing the desired spaces between stringers. The counter 138 may be of the type discussed in a co-pending application Serial No. 214,254 filed June 17, 1938, now Patent No. 2,167,259, issued July 25, 1939.

The preferred forms of apparatus used in the practice of my invention are more fully described hereinafter.

The rolling mill

The general arrangement and operation of the rolling mill has already been described with reference to Figs. 1, 2, 3 and 24. The details of the rolling mill itself are now described with more particular reference to Figs. 10 through 17 of the drawings. Referring to those figures, the upper roll 60 is formed with a conical shank 140 (Fig. 13) received in a matingly tapered member 142 which is itself received with a tapered fit in a main shaft of massive dimension 144. Shaft 144 is carried in a tapered roller bearing 146, this bearing functioning to prevent axial movement as well as to take the direct radial thrust of the roller. The outer end of shaft 144 is carried in a ball bearing 148, this bearing being subjected primarily to radial thrust. The bearings are carried in a massive bearing housing 150 the ends of which are closed by bearing caps 152 and 154. These are provided with leather oil seals 156. The outer race of bearing 146 is held in place by bearing cap 152. The inner races are held in place by nuts 158 and 160 threadedly received on the main shaft and held against relative rotation by the oppositely bent tabs of a suitable lock washer 162. Bearing 148 is held in place by collar 164. The roll 60 is internally threaded and is drawn into the main shaft carrying the same, by means of a suitable draw bolt 166 the head 168 of which is exposed at the end of the machine.

The lower roll 62 is carried in the same way in a similar main shaft which in turn is carried in the same way in similar tapered bearings and ball bearings. These bearings are carried within a massive bearing housing 170 the ends of which are closed by bearing caps 172 and 174. Insofar as the bearing housings differ from one another in order to make possible certain desirable adjustments, these differences and the reasons therefor will be pointed out hereinafter. At this time I shall proceed with a description of the main driving elements of the rolling mill. Referring to Fig. 10, the shaft of lower roll 62 has a gear 176 secured to its outer end. This gear meshes with a pinion 178 carried on a countershaft 180. Countershaft 180 extends through the elevated base 182 of the machine and carries pulleys 184 which are belted to the driving motor of the rolling mill. Hand wheel 186 is provided for use during adjustment of the machine.

The opposite end of countershaft 180 carries a pinion 188 meshing with an idler pinion 190 which in turn meshes with a gear 192 carried at the outer end of the main shaft of upper roll 60. The relation of pinion 188, idler 190 and gear 192 will be clear from inspection of Fig. 16. This may be compared with Fig. 17, showing a direct engagement between pinion 178 and gear 176 at the opposite end of the machine. Pinions 178 and 188 are preferably identical in pitch, diameter and number of teeth, and the same applies to the gears 176 and 192. The rolls are therefore driven at equal rotative speeds but in opposite directions, due to the effect of the direction-reversing idler 190. The desired clearance between the teeth of pinion 188 and gear 192 is obtained because of the difference in elevation of the rolls 60 and 62, the idler 190 being associated, of course, with the upper roll.

It will be seen that with the arrangement here disclosed, the rolls may be small in diameter, yet may operate on the wire with a tremendous pressure and torque obtained by mounting the rolls in massive shafts and bearings having a diameter many times that of the rolls and driving the same through massive gearing made possible through the indirect countershaft drive.

For most efficient operation, it is desirable to provide for relative adjustment of the rolls in order to bring the impressions therein into perfect registration. I provide for rotative adjustment, axial adjustment, and for radial adjustment of the spacing between the rolls.

The rotative adjustment may be explained with reference to Figs. 13 and 14 of the drawings. Gear 192 is not secured directly to the main shaft 144. Instead, it is carried on a sleeve 194 keyed to main shaft 144 by means of key 196. Sleeve 194 is flanged at 198, and this flange is provided with a series of slots 200 best shown in Fig. 14. A ring 202 is placed over flange 198 and the flange is locked between ring 202 and the hub of gear 192 by means of bolts 204. It will be understood that by loosening the bolts 204, it is possible to oscillate gear 192 relative to roll 60, and when the rolls 60 and 62 have been brought in proper rotative registration, the bolts 204 are tightened to lock the parts together. The final test of proper registration, is, of course, obtained by examination of the wire emerging from the pressure rolls.

Axial adjustment of the rolls is obtained by affording axial movement of the entire bearing housing 150. Referring to Figs. 13 and 15, the bearing housing is guided during its axial movement by a special key or guideway 206 secured by bolts 208 onto the top of base 182 of the machine. Precision and controlled movement of the bearing is obtained by means of a micrometer screw 210 turned by a head 212 carrying a scale 214. The head is formed integrally with the scale and is much like a control knob, but is flattened at the sides, as is best shown in Fig. 15, thus adapting the same for use with a wrench. Micrometer screw 210 turns in a matingly threaded block 216 (Fig. 15) which is secured in place on the end of base 182 by means of mounting screws 218. The location of block 218 on the machine will be clear from inspection of Fig. 16, and in that figure it will be observed that this block is made small enough in dimension to fit between the teeth of gear 192 and pinion 188. The dial 214 is located outside the teeth of the gear, as will also be clear from Fig. 13.

The micrometer screw 210 is secured to bearing 160 by means of a connecting bolt 220 screwed into a block 222 depending from one end of the bearing where it is mounted in place by screws 224. The head 226 of bolt 220 is received within the head or knob 212, and when the bolt 220 is screwed tightly into block 22, the micrometer screw 210 is locked against rotation. When the axial adjustment is to be changed, the locking screw 220 is first loosened and the micrometer screw is then turned inwardly or outwardly a slight amount, depending upon the desired adjustment. The locking bolt 220 is then again tightened, thus bringing the bearing to proper position and at the same time locking the adjustment of the micrometer screw. It will be understood, of course, that at this time the main bolts mounting the bearing on the base are slack, and after the desired adjustment is obtained, these bolts are tightened. The mounting bolts in question are best shown at 228 in Fig. 11.

The third adjustment is an adjustment of the spacing between the rolls. This determines the degree of deformation of the wire and is a very important adjustment. The two adjustments already described are made only when fitting new rolls into the machine. The present adjustment, however, must often be made when changing from one reel of wire to another, and even in the course of rolling a single reel of wire, due to changes in diameter, hardness and flowability of the wire, and even changes in temperature, because when first starting up the machine the rolls are cold, whereas after a period of operation the rolls are hot. The adjustment is also of value in compensating for the wear of the rolls as they become old.

In the present machine, this adjustment is made possible by pivotally mounting the bearing housing 170 for movement about an axis 230 extending transversely of the axis of roll 62. Axis 230 is located as near as possible to gear 176 and remote from roll 62. It intersects the axis of roll 62. With this location, vertical adjustment of the roll does not change the axial adjustment of the rolls, nor is there any appreciable change in angularity. At the same time, vertical movement of gear 176 is minimized so that there is no appreciable change in the meshing of the gearing. It may be kept in mind that the movement sought by this adjustment is a matter of only one or a few thousandths of an inch.

The adjustment is obtained by means of a pressure screw 232 best shown in Fig. 13, this pressure screw being carried by an extension 234 of the base of bearing housing 170. It will be noted that the screw is located not merely beneath but beyond the rails, thus causing the reactive force at the axis 230 to be a downward force which in turn is taken up on pedestals extending upwardly from the base of the machine. The lower end of the screw 232 bears against a hardened block 236 resting on the base 182 of the machine.

Referring to Figs. 11, 12 and 13, the pressure screw 232 carries an arm 238 at its upper end, and this arm is in turn connected to an adjusting screw 240 the inner end of which is connected to arm 238 by means of a self-aligning bearing 242. The outer end of screw 240 is provided with a scale 244. Adjusting screw 240 is reciprocated by means of a matingly threaded nut 246 (Fig. 11) formed integrally with a sleeve 248 surrounding scale 244. A conveniently manipulatable knurled adjusting handle 250 (Figs. 16 and 17) is secured to sleeve 248. The sleeve and nut are carried in a self-aligning ball bearing 252. It will be understood that on rotating handle 250, the adjusting screw 240 is moved axially and functions to slightly oscillate arm 238, which in turn slightly rotates the pressure screw 232, thereby changing the spacing between the rolls. A very fine adjustment is obtainable because several revolutions of the adjusting handle may be used to move a single division on the scale 244, and a single division on scale 244 results in a change of center to center distance between rolls of only one-thousandth of an inch. This mechanism affords a convenient precision adjustment which is self-locking because of the use of screws.

Bearing housing 170 is pivoted in the following manner. The housing has blocks 254 secured thereto, as by means of bolts 255, these blocks being turned to semi-cylindrical configuration on the lower side to act as the upper half of trunnion bearings (see Figs. 13 and 17). The base 182 of the machine has a pair of bearing pedestals 256 most clearly shown in Figs. 10, 11 and 17, though the upper end of one of the pedestals is visible in Fig. 13. Trunnion bearing blocks 257 are bolted to the upper ends of pedestals 256, as is best shown in Fig. 13. Blocks 257 are turned on their upper side to approximately semi-cylindrical configuration. Cylindrical pins or loose trunnions 230 are disposed between the trunnion bearing blocks 254 and 257. There is a small space between the blocks, they being held apart by the pins 230, as is clearly shown in Fig. 13, and this affords the desired oscillatable mounting of bearing housing 170 about the pins 230.

Pins 230 are held within the bearing blocks 254 and 257 because these blocks are closed at their outer ends, as is best shown at 258 in Figs. 10 and 17. The bearings are held together by a split collar 260, and this is received in a mating groove, as is best shown in Fig. 17. These collars are not relied upon to prevent sideward movement of the main bearing, for that is fixed in location with the aid of a large key or guide 262 best shown in Fig. 13.

The arrangement of the parts is such that the forces developed at adjusting screw 232 and at the pressure rolls, tend to force the outer end of bearing housing 170 downwardly against trunnion pins 230 and pedestals 256. It is for this reason that the bearing housing has its trunnion block 254 acting as the upper half of the bearing, and it is also for this reason that the top of bearing housing 170 is reinforced by a web 264 extending transversely over the bearing housing between the supports for the trunnion bearing blocks 254.

As so far described, it would be impossible to remove the rolls from the machine, because the large massive bearings are in the way of any attempted outward axial movement of the rolls. This will be clear from inspection of Fig. 10. I therefore arrange the machine so that one of the bearings, specifically the upper bearing housing 150, may be tilted or swung bodily out of the way of the lower bearing housing 170. For this purpose, the base of bearing housing 150 is formed with a projection 266 carrying a handle 268. Projection 266 acts as a bearing received between bearing ears 270 formed integrally with base 182. A pin 272 extends through bearings 266 and 270. After preliminarily removing the main attaching bolts 226 and the bolt 220 passing through the axial adjustment screw, handle 268 may be swung downwardly about pin 272, thus swinging the entire bearing housing 150 bodily out of line with bearing housing 170. It will be evident from Fig. 16 that the gearing does not interfere with this movement of bearing housing 150. Fig. 16 also clearly shows a stop projection 274 which is formed integrally with base 182 and which limits the tilting movement of the main bearing. The bearing housing fit at pin 272 is made very loose in order not to interfere with proper seating of the bearing housing on the base when the bearing housing is secured by the bolts 226, and referring to Fig. 11, it will be seen that the holes in bearings 270 are enlarged as indicated at 273, thus providing adequate clearance for this purpose.

Fig. 12 is a view looking toward the lower main bearing housing 170 when the upper main bearing housing has been swung out of the way. The pressure roll 62 may be removed after first preliminarily unscrewing the draw bolt holding the same in place, the head of this draw bolt being indicated at 276 in Figs. 10 and 17. Fig. 12 is also interesting in showing the comparatively tiny nature of the pressure roll 62 contrasted with the end of main shaft 144. This figure also shows a wire guide finger 278 which follows the last of the straightening rolls 32, and which leads the wire up to a point directly between the pressure rolls. Guide finger 278 is made of a lower channel portion and a cover plate 280 screwed thereon. The entire guide finger is carried in a suitable bracket 282 projecting upwardly from the base of the machine. The use of this guide finger is particularly important because it makes it unnecessary to provide the pressure rolls with a special channel for receiving the wire. It may be mentioned that the wire guide 278 should be removed before attempting to remove the pressure roll 62. Fig. 12 also shows a pair of guide wheels 284 which receive the element wire 14 as it leaves the pressure rolls.

I have found, after long experimentation and study of this problem, that best results may be attained by using pressure rolls of very small diameter (but, it goes without saying, not so slender as to break or shear off under the rolling load). More specifically, the pressure rolls should be less than two inches in diameter, and I prefer and recommend rolls which are only one inch in diameter. The permissible roll diameter theoretically varies somewhat with the size (really the impression depths) of the fastener elements being made, and the above specification is applicable to the manufacture of the most common size of slide fastener, that used on brief-cases, windbreakers, or the like. The permissible roll diameter also varies with the ductility or deformability of the metal. A larger roll than above specified might be used with a metal such as aluminum or white metal alloys, which do not harden quickly when deformed.

But the metals actually used for slide fasteners, such as zinc copper or nickel zinc copper alloys, harden quickly as they are deformed. There is benefit in quicker clearance of the parts of the roll from the part of the wire already rolled or formed.

Any discussion of the theory underlying the invention is offered by way of probable explanation and is not intended as a limitation of the invention which, if desired, may be considered to be an empirical discovery independent of underlying theory.

The attaching machine

The attaching machine is shown in a general way in Figs. 8 and 9, but is described in greater detail with reference to Figs. 18 through 22. Referring first to Fig. 21, the punch 98 referred to in connection with Fig. 7 is mounted on a vertically reciprocable ram 290 held normally in elevated position by a compression spring 292. The ram is carried and guided by adjustable ways 294 (Fig. 18) mounted in an upstanding block 296. The return spring 292 is housed within block 296, the upper end of the spring bearing against a stop pin 298, the shank 300 of which is secured in ram 290. The lower end of the spring bears against a part of block 296, as is clearly shown in Fig. 21.

The ram is forced downwardly by oscillation of a ram lever 302 pivotally mounted at 304. The driving force of the lever is applied to the ram through an adjustable stud 306 the lower end of which is preferably provided with the hardened insert 308, (Fig. 21) said insert bearing on the hardened block 310 mounted at the top of the ram. Referring to Figs. 18 and 19, it may be explained that lever 302 is bifurcated to clear the tape 92 and tape drum 130. The spaced depending arms 314 each carry a cam follower roller 316 riding on cams 318 which in turn are mounted on the main drive shaft 320 of the machine. It may be mentioned that the fulcrum pin 304 of ram lever 302 is made readily removable, and when the fulcrum pin is drawn out of the stationary bearings 322 of brackets 324, the ram lever 302 is removable from the apparatus, thereby making the ram and associated parts of the machine accessible. The block 296 is bodily elevatable after removing the screws 326 (Fig. 18), thus affording full access to the punch and feed dogs.

Punch 98 works in a die 328 (Fig. 21), and the punch is provided with generous guides or heels 330 (Fig. 20) which remain in engagement with the die even when the punch is elevated. The punchings or waste metal like the piece 102 shown in Fig. 23, fall through die 328 into a tube or chute 332, and thence into a suitable box beneath the machine.

In describing the process of the invention in connection with Figs. 6 and 7, it was explained that one main operation was the finishing and severing operation performed by the punch 98. The other main operation was the closing of the jaws of the element to clamp the element tightly on the beaded edge of the tape 92. This clamping operation is performed by clamping plates 96, best shown in Fig. 20 of the drawings. It will be seen that these plates are mounted on clamping levers 334 pivoted at 336 and provided at their opposite ends with cam follower rollers 338. These cam follower rollers cooperate with a symmetrically arranged cylindrical cam 340 which is mounted directly on the main drive shaft 320 of the machine. The cam is preferably arranged for positive movement of the clamping levers in both directions. The plates 98 are made separately because they are thin, hardened plates, their vertical dimension being limited by the necessity of operating on one element without interfering with the immediately adjacent element on the tape. It will also be understood that while the range of movement of the clamping plates is small, it is adequate to receive the end-most element of the wire with its jaws in widely spread or divergent condition.

Referring to Fig. 21, the element wire 14 is shown moving from left to right. It is intermittently moved in step by step fashion by means of a feed dog 342 carried at the end of a feed arm 344 pivotally mounted at 346, between bearings 348 projecting upwardly from a slide 350. Pin 352 is carried in the forked end 354 of a feed lever 356, best shown in Fig. 18. Referring to that figure, it will be seen that lever 356 is pivoted at 358 and carries at its remote end a cam follower roller 360 cooperating with a cylindrical cam 362 mounted on the main drive shaft 320 of the machine. Cam follower 360 is held against cam 362 by means of a compression spring 364 carried on a bolt 366. The inner end of the bolt is secured to the frame of the machine, while the outer end carries nuts 368 bearing against the outer end of spring 364. The inner end of the spring bears against a part of lever 356, and this tends to oscillate the lever in a clockwise direction.

Slide 350 is guided by appropriate rails 370. The pins 346 forming a part of the slide are normally pulled toward retracted position by means of pull springs 372 clearly shown in Figs. 18 and 20. This insures retraction of the feed dog despite the existence of play or lost motion in the feed linkage. The amount of movement of the feed dog is constant, and corresponds to the throw of the feed cam 362, and this amount may be made greater than the pitch between successive elements so long as it does not reach twice the pitch, for the extra motion is used up as lost motion behind the head of the next element to be fed. The terminal point of the element depends, therefore, on the location of the feed dog rather than its extent of movement, and this may be varied by varying the location of pin 352 in the forked end 354 of feed lever 356. Referring to Fig. 21, it may be seen that the bifurcations of the feed lever carry adjustable screws 374 bearing against pin 352. The final location of the element to be severed is determined with even greater precision by adjustment of a stop screw 376 the end of which bears against a stop pin 378 inserted in block 296. The adjustment of screw 376 is locked by means of a nut 380. Screw 376 may, if desired, be provided with a handle 384 to facilitate adjustment of the screw, this handle being secured in place by a suitable set screw.

The feed dog 342 is normally urged downwardly against the element wire 14 by means of a pull spring 386 best shown in Fig. 19. The upper end of this spring is carried on a stationary plate 388 secured to bearings 348, while the lower end of pull spring 386 is received on the outer or free end of the stop screw 376 previously referred to. Feed dog 342 is preferably shaped to fit around the element wire so as to help center the same, and also to fit against the head of the element when moving the same. It readily slides backwardly, however, over the head of the next element during retraction of the feed dog.

The element wire is held against return movement by a check dog 390 best shown in Fig. 21. This dog is carried on a spindle 392 mounted in a block 394 disposed beneath the feed dog and stationarily mounted on the frame of the machine by screws 396, as is best shown in Fig. 20. Check dog 390 is inserted in spindle 392 and is locked in position by means of a set screw 398 passing axially through the shaft, as is shown in Fig. 20. Shaft 392 has an upstanding arm 400 to which is connected one end of a pull spring 402 the opposite end of which is connected to the frame of the machine at 404. In this way the check dog is urged in a clockwise direction as viewed in Fig. 21, thus holding it in engagement with the element wire. However, the dog is free to ride upwardly over the heads on the wire, as the wire is advanced by the feed dog. Return movement of the wire is, of course, effectually prevented by the check dog. The feed dog acts on the wire as near as possible to the punch, and the check dog is therefore located outside the tip of the feed dog.

Spacing between stringers is obtained by interrupting the feed of the element wire 14 while continuing the feed of the tape 92. This is done, in the specific machine here shown, by elevating the check dog 390 from the position shown in Fig. 21, to the position shown in Fig. 22. For this purpose the arm 400 of shaft 392 has connected to it a wire link 406 best shown in Fig. 20. Referring to Figs. 18 and 19, it will be seen that the link 406 is connected at its rear end to a pin 408 projecting upwardly from a rod 410 one end of which is bent to crank-shape at 412 where it is connected to the plunger 414 of a solenoid 416. Solenoid 416 is energized through appropriate switch contacts forming a part of the counter 138, the details of which are not material to the present invention and may be found in my copending application Serial No. 214,254, filed June 17, 1938, now Patent No. 2,167,259, issued July 25, 1939, previously referred to. For the present, it is sufficient to say that the counter is operated through a ratchet wheel 418 the dog of which is oscillated through a link 420 extending back toward the main shaft 320 of the machine and there connected on an eccentrically located pin 422 (Fig. 19). The counter is thus responsive to the number of revolutions of the machine, which in turn corresponds to the number of elements attached on the tape, and after a predetermined desired number of elements have been attached, the switch mechanism of the counter energizes solenoid 416, thus elevating the check dog 390 and permitting the element wire 14 to merely vibrate back and forth without feeding any new elements to the tape until the machine has continued rotating an additional number of times corresponding to the desired space between stringers, whereupon the solenoid 416 is again de-energized, check dog 390 is restored to normal position, and the severing and attachment of the elements to the tape proceeds as before until the desired stringer length has again been produced.

The beaded tape 92 is fed upwardly from beneath the machine as is shown in Figs. 19 and 21, it being loosely supplied from a basket. If desired, the basket may be located at a point away from beneath the machine, and in such case the tape is first fed to an elevated guide 424 (Fig. 9) whereupon it is fed downwardly and around another guide beneath the machine and then upwardly through the punching die. The tape is guided through a closely fitting keyhole shaped slot in the die, best shown at 426 in Fig. 20. The tape is tensioned by squeezing it between stationary and movable blocks, the stationary block being indicated at 428 (Fig. 18) and the movable block at 430 (Figs. 18 and 19), said movable block being carried at the end of an arm 432 which is urged against the tape by a tension spring 434. The opposite end of the spring is connected to a screw 436 manually movable by means of a threaded handle 438. Normally the spring is under tension, but when it is necessary to start a new tape into the machine, the tension of the spring may be temporarily relieved by rotating handle 438.

The stringer of tape with elements secured thereto is twisted ninety degrees during its passage from the clamping station upwardly through bifurcated ram lever 302, and is then passed around the tape feed drum 130 (Figs. 18 and 19). This drum is preferably knurled (see Fig. 18) for better frictional engagement with the surface of the tape, the latter being held against the drum by means of a shoe 440 carried in the bifurcated end 442 of a bolt 444 around which a compression spring 446 is coiled. The bolt is carried in the end 448 of a bracket 450 projecting from one of the bearings 324 of the machine. The pressure may be released when desired, and when threading the machine with a new tape, by swinging lever 452, the hub 454 of which is provided with camming bumps 456 adapted to move the bolt and friction shoe against the pressure of spring 446. Tape feed drum 130 is cut away or recessed at one edge, as is indicated at 458 (Fig. 18) in order to clear the elements of the stringer, the operation of the drum being directly upon the web of the tape rather than upon the elements secured thereto.

Tape feed drum 130 is mounted on shaft 460 journalled in a stationary bearing 462 and carrying at its outer extremity a ratchet wheel 136. Ratchet wheel 136 cooperates with a feed pawl 464 (Fig. 19) pivotally mounted at 466 on one end of an oscillatable feed arm 468 which oscillates freely on shaft 460 between ratchet wheel 136 and bearing 462. The enlarged hub of feed arm 468 carries an oppositely directed arm 470 the outer end of which is forked and pivotally connected to a connecting rod 472. The lower end of connecting rod 472 is carried on an eccentric 474 mounted on the end of the main shaft 320 of the machine (though inside of the crank pin 422 for the counter). The proportioning of the parts is made such that the tape is advanced step by step an amount equal to the desired spacing between successive elements on the tape. Return movement of the feed drum is prevented by a holding dog 476 pivoted on bracket 462 at 478. The dogs 464 and 476 are held against the ratchet wheel by pull springs 480 and 482.

It will be seen from the above description and from the drawings that the severing punch, clamping jaws, tape feed pawl, wire feed dog, and counter are all operated in a simple and direct manner by the single main cam shaft 320, and that the reciprocating parts are kept short in stroke, and small and light compared, for example, to the reciprocating head of an ordinary punch press. The machine is therefore adapted for very high speed operation.

The main drive shaft 320 carries a pulley 484, (Fig. 18), and this is driven by a belt running to an electric motor (not shown) mounted on the bottom of the base 486 of the machine. The motor and belt are concealed from view in Fig. 8 by a guard plate 488. The shaft 320 is preferably also provided with a fly wheel 490, which may be used when adjusting the machine, as a hand-wheel.

Advantages

It is believed that the method of my invention, as well as the construction and operation of a preferred form of apparatus for practicing the invention, and the many advantages thereof, will be understood from the foregoing detailed description thereof. Some of these advantages are reviewed hereinafter. The embryo elements are made in large quantity and at high speed in a piece of apparatus especially designed for that purpose, and are finished, severed and attached in another piece of apparatus. This leads to greater flexibility in manufacture and in meeting the requirements of customers and leads to greater efficiency of operation, for the rolling mill may operate continuously and without as many interruptions as are required in connection with the attaching machine. The number of machines may be properly adjusted in relation to the relative speeds thereof. Because the heavy work is done in the rolling mill, the attaching machine is a light-duty piece of apparatus and may be operated at very high speed. A speed several times the speed of any other slide fastener apparatus of which I am aware is readily obtainable. The rolling mill, however, is even faster, and this is all the more unusual because this is the heavy-duty part of the apparatus. The rolling mill may be operated at a speed corresponding to the manufacture of thousands of elements per minute. If the element wire were being formed in a reciprocating press, it is manifest that the press could not be operated at such an extremely high speed. The shaft would have to turn at the same high speed, whereas the mill shaft turns only a few hundred R. P. M. The output of the rolling mill is even greater than would be indicated by the above figures, because, as has previously been mentioned, there is no interruption of the rolling mill at the time that the attaching machine is interrupted to produce the spacing between stringers. For this reason it is readily possible to supply element wire for four or five attaching machines from a single rolling mill.

With the present invention it is possible to form relatively broad flat elements of conventional character from simple uniform round wire stock, thus minimizing the cost of the raw material. The amount of scrap or waste is reasonably small because the metal connecting the successive elements is reduced to a comparatively thin web. The element wire is formed throughout a continuous length or reel of stock, and reels carrying a mile or more of element wire are readily and conveniently handled by the above described apparatus.

The formation of the element wire in a rolling mill results in a substantially uniform pitch or spacing of the elements along the wire, and this is important for the production of a smooth running slide fastener. This uniformity of pitch is obtained while using ordinary commercial round wire stock which is subject to variations in diameter, hardness and flowability. The extensive deformation or mutilation of the wire in the rolling mill is accompanied by a stretch or elongation, but this elongation is accommodated by using exceedingly small pressure rolls. These also have the advantage of producing a comparatively good shaping of the complex embryo elements, and of reducing the force between the rolls. A larger diameter roll would tend to insure absolute uniformity of pitch but raises other difficulties. The small diameter roll produces a very nearly uniform pitch which is adequate for making a smooth-running slide fastener. The pitch is very uniform indeed compared with the troublesome irregular pitch obtained when coining elements under the best of conditions in a reciprocating press. The element wire is formed in a single passage through the rolls, thus avoiding difficulties of registration which would arise because of successive elongations if the stock were passed through successive rolls. The rolling mill is so arranged that despite the tiny size of the rolls, they are carried in massive shafts and bearings and are driven by massive gearing. Rotational and axial adjustment of the rolls, as well as convenient precision adjustment of the spacing between rolls are all provided for.

The separation of the element manufacture into two parts as here disclosed eliminates the problem of hoppering and assorting a mass of loose elements, this being a step which has always been troublesome because of the rather complex unsymmetrical nature of the elements with their divergent jaws. At the same time, the disadvantages of attempting to perform all of the necessary operations in a single machine are avoided.

This application is a continuation in part of my co-pending applications Serial No. 750,609, filed October 30, 1934, and entitled "Method and apparatus for making slide fasteners," and Serial No. 79,047, filed May 11, 1936, and entitled "Manufacture of slide fasteners."

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made without departing from the spirit of the invention defined in the following claims.

I claim:

1. The method of making interlockable elements for a slide fastener, which includes the step of preliminarily pressing and thereby deforming, without cutting, the entire length of a long continuous strip of uniform wire stock to form a connected series of embryo fastener elements therefrom, each of said embryo elements comprising a solid embryo head and widely divergent embryo jaws, the head being narrow and adapted to interlock with the heads of adjacent elements when the elements are mounted on the slide fastener, and the embryo jaws diverging outwardly from the embryo head, said connected elements being arranged longitudinally of the strip in end to end relation with the divergent embryo jaws pointing generally toward one end of the strip, there being substantially no waste material outside the embryo jaws of the elements.

2. The method of making interlockable elements for a slide fastener, which includes the step of preliminarily pressing and thereby deforming the entire length of a long continuous strip of uniform wire stock to form an integrally connected series of embryo fastener elements therefrom, each of said embryo elements comprising a solid embryo head and widely divergent embryo jaws, the head being narrow and adapted to interlock with the heads of adjacent elements when the elements are mounted on the slide fastener, and the embryo jaws diverging outwardly from the embryo head, and said connected embryo elements being arranged longitudinally of the strip in end to end relation with the embryo jaws pointing toward one end of the strip, and at the same time pressing the connecting material between the embryo heads and jaws of the successive embryo elements down to a thin web of material adapted to be subsequently punched away for completion and separation of the elements.

3. The method of manufacturing a slide fastener wire, which includes preliminarily running a continuous uniform solid wire between a single pair of rotating pressure coining rolls, the surfaces of which are shaped negatively to portions of the desired fastener elements, and thereby forming in a single rolling coining operation a relatively broad flat wire having a continuous series of projections uniformly spaced on one side of the wire, and corresponding recesses uniformly spaced on the opposite side of the wire for the heads of the fastener elements, the wire being wider than the projections and recesses and the marginal portions thereof acting to provide material for the formation of spread jaws when the elements are severed from the wire, the coining impressions in the rolls being such that the slide fastener wire is adapted to be severed into a series of elements arranged longitudinally of the wire and all pointing in the same direction.

4. The method of manufacturing embryo slide fastener elements which includes preliminarily running a continuous uniform solid wire between a single pair of rotating pressure coining rolls the surfaces of which are shaped negatively to the desired embryo elements and thereby forming in a single rolling coining operation a continuous series of relatively broad flat connected embryo slide fastener elements, each of said elements having an embryo head with angularly spread embryo jaws connected thereto, and said embryo heads being uniformly spaced along the wire and each having a projection and a recess, the coining impressions in the rolls being such that the coined embryo elements are arranged longitudinally of the wire and all point in the same direction.

5. The method of manufacturing embryo slide fastener elements, which includes preliminarily running a continuous uniform round metallic wire between rotating pressure rolls the surfaces of which are shaped negatively to the desired embryo elements, and thereby forming a continuous series of relatively broad flat connected embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected by a web of metal between the spread embryo jaws.

6. The method of manufacturing a slide fastener wire, which includes preliminarily running a continuous uniform wire between rotating pressure rolls, the surfaces of which are shaped negatively to portions of the desired fastener elements, and at intervals measuring the rolled wire and adjusting the spacing between the rolls to compensate for changes in the diameter and deformability of the wire being supplied to the rolls in order to maintain uniformity in the resulting slide fastener wire.

7. In the manufacture of slide fasteners, the method which includes pressing, without cut-

ting, a continuous wire stock in order to deform the same into a connected series of embryo fastener elements, each of said elements comprising an interlockable embryo head portion and divergent embryo jaw members, the embryo head of each member being connected to the divergent embryo jaws of the adjacent member, and reeling said stock, whereby the stock may be stored and thereafter unreeled as needed to fill particular orders for slide fasteners.

8. In the manufacture of slide fasteners, the method which includes pressing, without cutting, a continuous round wire stock in order to deform the same into a connected series of embryo fastener elements, each of said elements comprising an interlockable embryo head portion and spread embryo jaw members, the embryo head of each member being connected to the spread embryo jaws of the adjacent member with the elements arranged end to end, the embryo head and spread jaws of the element being wider than the diameter of the round wire stock, and reeling said stock with the embryo elements head first, whereby the formed stock may be stored and thereafter unreeled jaw first as needed to fill particular orders for slide fasteners.

9. The method of manufacturing embryo slide fastener elements which includes preliminarily running a continuous uniform wire between rotating pressure rolls the surfaces of which are shaped negatively to the desired embryo elements and thereby forming a continuous series of connected embryo slide fastener elements, each of said elements having an interlockable embryo head with angularly spread embryo jaws connected thereto, said elements being connected end to end with the embryo head of one element connected to the angularly spread embryo jaws of the next element, the rolls being rotated in proper direction to form the embryo elements pointing head first, and thereupon reeling the wire with the embryo elements pointing head first, for storage and subsequent utilization.

10. The method of manufacturing embryo slide fastener elements, which includes preliminarily running a continuous round metallic wire between rotating pressure rolls the surfaces of which are shaped negatively to the desired embryo elements and thereby forming a continuous series of connected embryo slide fastener elements, each of said elements having an interlockable embryo head with spread embryo jaws connected thereto, said elements being connected end to end with the embryo head of one element connected to the open embryo jaws of the next element, the rolls being rotated in proper direction to form the embryo elements pointing head first, the embryo head and open jaws being wider than the diameter of the round wire stock, permitting elongation of the wire as it is formed between the rools by freeing the wire from the rolls promptly after forming the same, and thereupon reeling the wire with the embryo elements pointing head first for storage and subsequent utilization.

11. In the manufacture of slide fasteners, the method which includes pressing a continuous round wire stock in order to deform the same into a connected series of embryo fastener elements, each of said embryo elements comprising an interlockable embryo head portion and divergent embryo jaw members, the embryo head of each element being connected to the divergent embryo jaws of the adjacent element by a thin web of metal, with the embryo elements arranged end to end, the embryo head and jaws of the embryo element being wider than the diameter of the round wire stock, reeling said stock, whereby the formed stock may be stored and thereafter unreeled as needed to fill orders for slide fasteners, and thereafter severing successive elements from the formed wire by punching away the thin web of metal to form the finished elements.

12. The method of manufacturing slide fasteners, which includes preliminarily running a continuous uniform wire between rotating pressure rolls, the surfaces of which are shaped negatively to portions of the desired fastener elements, reeling the wire with the embryo elements pointed head first, thereafter unreeling the wire so that the embryo elements point in opposite direction, feeding the same intermittently toward a tape, severing successive elements one after another from the strip while shaping element jaws and clamping element jaws of one element after another on the tape, and intermittently feeding the tape in a longitudinal direction.

13. In the manufacture of a stringer for a slide fastener, said stringer comprising a series of elements secured along one edge of a tape, the method which includes pressing and thereby deforming, without cutting, a continuous wire to form an integrally connected series of embryo fastener elements therefrom, each of said elements comprising an interlockable solid embryo head portion and angularly spread embryo jaws, the spread embryo jaws being wider than the original stock, said connected embryo elements being arranged longitudinally of the strip in end to end relation with the divergent embryo jaws pointing generally toward one end of the strip, intermittently feeding the continuous pressed wire with the elements pointing jaw first toward a tape, severing successive elements one after the other from the wire and clamping element jaws of one element after another on the tape, and intermittently feeding the tape.

14. The method of making a stringer for a slide fastener which includes pressing and thereby deforming, without cutting, a continuous strip of stock to form a connected series of embryo fastener elements, each of said elements comprising an interlockable embryo head portion and angularly spread embryo jaws, the embryo head of each member being connected to the spread embryo jaws of the adjacent member, reeling said stock with the embryo elements pointing head first, thereafter unreeling said stock with the embryo elements pointing jaw first, and feeding the same intermittently toward a tape, severing successive elements one after another from the strip and clamping element jaws of one element after another on the tape, and intermittently feeding the tape in a longitudinal direction.

15. The method of making a stringer for a slide fastener, which includes pressing and thereby deforming, without cutting, a continuous strip of stock to form a connected series of embryo fastener elements therefrom, each of said elements comprising an interlockable embryo head portion and spread embryo jaws, reeling said stock, thereafter unreeling said stock and feeding the same intermittently toward a tape, intermittently feeding the tape in a longitudinal direction, clamping the jaws of the first element on the tape and severing the first element from the next succeeding element, the severing and clamping operations being performed at about

the same time, thereupon advancing the tape and stock, and so on.

16. The method of making a stringer for a slide fastener, which includes pressing and thereby deforming, without cutting, a continuous strip of stock to form a connected series of embryo fastener elements therefrom, each of said elements comprising an interlockable embryo head portion and spread embryo jaws, the embryo head of each member being connected to the spread embryo jaws of the adjacent member, reeling said stock with the embryo elements pointing head first, thereafter unreeling said stock with the embryo elements pointing jaw first and feeding the same intermittently toward a tape, intermittently feeding the tape in a longitudinal direction, clamping the jaws of the first element on the tape and severing the material connecting the first element to the next succeeding element, the severing and clamping operations being performed at about the same time, thereupon advancing the tape and the stock, and so on.

17. The method of making a stringer for a slide fastener, which includes deforming, without cutting, continuous round wire stock to form a connected series of embryo fastener elements therefrom, each of said elements comprising an interlockable embryo head portion and spread embryo jaws, the embryo head of each element being connected to the embryo jaws of the adjacent element, reeling said deformed wire with the embryo elements pointing head first, thereafter unreeling said wire with the embryo elements pointing jaw first and feeding the same intermittently toward the beaded edge of a tape, intermittently feeding the tape in a longitudinal direction, clamping the jaws of the first element around the bead of the tape and severing the material connecting the first element to the next succeeding element, the severing and clamping operations being performed at about the same time, thereupon advancing the tape and feeding the wire to bring the next element in engagement therewith, and so on.

18. In the manufacture of a stringer for a slide fastener, said stringer comprising a series of elements secured along one edge of a tape, the method which includes pressing and thereby deforming, without cutting, a continuous strip of narrow stock to form an integrally connected series of embryo fastener elements therefrom each of said elements comprising an interlockable solid embryo head portion and widely spread embryo jaws, the spread embryo jaws being wider than the original stock, said connected embryo elements being arranged longitudinally of the strip in end to end relation with the divergent embryo jaws pointing generally toward one end of the strip, intermittently feeding the tape, intermittently feeding the continuous strip of pressed stock with the embryo elements pointing jaws first, clamping the jaws of the first element on the tape and thereafter severing the first element from the succeeding element, and thereupon again feeding the tape and strip preparatory to clamping the next element in place on the aforesaid tape.

19. In the manufacture of a stringer for a slide fastener, said stringer comprising a series of elements secured along one edge of a tape, the method which includes pressing and thereby deforming a continuous strip of narrow stock to form an integrally connected series of embryo fastener elements arranged end to end, each of said embryo elements comprising an interlockable solid embryo head portion and widely spread embryo jaws, the connecting material between the embryo heads and spread jaws of the successive embryo elements being pressed down to a thin web of material adapted to be punched away for completion and separation of the elements, intermittently feeding a tape, intermittently feeding said strip toward the tape with the embryo elements jaws first, clamping the jaws of the first element on the tape and at about the same time punching away the thin web of material connecting the said first element to the succeeding elements, and thereupon again feeding the tape and strip preparatory to clamping the next element on the aforesaid tape.

20. The method of making a stringer for a slide fastener which includes pressing and thereby deforming, without cutting, a continuous round wire stock to form a connected series of embryo fastener elements therefrom, each of said embryo elements comprising an interlockable embryo head portion and spread embryo jaws, the embryo head of each embryo element being connected to the embryo jaws of the adjacent embryo element by a thin web of connecting material, reeling said deformed wire with the embryo elements pointing head first, thereafter unreeling said wire with the embryo elements pointing jaw first and feeding the same intermittently toward the beaded edge of a tape, intermittently feeding the tape in a longitudinal direction, clamping the jaws of the first element around the bead of the tape, thereafter punching away the web of material connecting the first element to the next succeeding element in order to sever and finish shaping the first element, and thereupon advancing the tape and feeding the punched wire to bring the jaws of the next element into engagement with the tape, and so on.

21. A step product in the manufacture of slide fasteners, said step product comprising a long wire made up of a continuous integrally connected series of embryo fastener elements, each of said embryo elements comprising a solid embryo head portion and widely divergent embryo jaws, and said connected embryo elements being arranged longitudinally of the strip in end to end relation with the embryo jaws pointing toward one end of the strip, the embryo head of each embryo element being connected to the spread embryo jaws of the adjacent embryo element by a thin web of material which fills the space within said spread of jaws and head, and which is adapted to be punched away for completion of the shaping of the outline of the elements and for separation of the elements, said web of material having a thickness only a small fraction of the thickness of the element.

22. A step product in the manufacture of slide fasteners, said step product comprising a reel of wire the entire length of which is pressed, without cutting, and thereby deformed into a connected series of embryo slide fastener elements, each of said elements comprising an interlockable embryo head portion and spread embryo jaws, the embryo head of each embryo element being connected to the spread embryo jaws of the adjacent embryo element with the embryo elements arranged end to end and longitudinally of the wire, said embryo elements all pointing in the same direction and being reeled in such direction that the embryo elements point jaw first when unreeled from the reel.

23. A step product in the manufacture of slide

fasteners, said step product comprising a reel of wire the entire length of which is pressed to form a connected series of embryo slide fastener elements, each of said embryo elements comprising an interlockable embryo head portion and divergent embryo jaws, the embryo head of each embryo element being connected to the divergent embryo jaws of the adjacent embryo element by means of a thin web of metal which fills the space within said spread jaws and head, and which is adapted to be punched away, the embryo elements being arranged end to end and longitudinally of the wire, said embryo elements all pointing in the same direction and being reeled in such direction that the embryo elements point jaws first when unreeled from the reel.

24. Apparatus for the manufacture of slide fasteners, said apparatus comprising a reel to supply a continuous wire, means to press and thereby deform, solely by pressing and without cutting, the wire into a connected series of embryo fastener elements, each of said elements comprising an interlockable embryo head portion and spread embryo jaws, and a reel on which the formed wire is wound as fast as it is formed, for storage until needed.

25. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to supply a continuous round wire, means to squeeze and thereby deform the round wire into a connected series of embryo fastener elements, each of said elements comprising an interlockable embryo head portion and spread embryo jaws, the embryo head of each embryo element being connected to the spread embryo jaws of the adjacent embryo element with the embryo elements arranged end to end longitudinally of the wire, and a reel on which the formed wire is wound as fast as it is formed, for storage until needed, the wire deforming means being so shaped as to form the embryo elements with the embryo heads pointing toward the reel on which the formed wire is being wound.

26. Apparatus for manufacturing a slide fastener wire or connected series of embryo slide fastener elements, each of said elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, and means to support and synchronously rotate the rolls in mating registration.

27. Apparatus for transforming a smooth wire into an element wire or a connected series of embryo slide fastener elements, each of said embryo elements having a projection and a recess, said apparatus comprising two small diameter pressure rolls having peripheries formed generally negatively to the desired element wire, the roll impressions being such as to intermittently compress the wire at the middle to spread the wire at regularly spaced points along the wire and to thereby force the metal outwardly to form angularly projecting embryo jaw ends.

28. Apparatus for manufacturing a slide fastener wire or connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising two small-diameter pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, said rolls having a diameter of less than two inches and preferably having a diameter of only one inch or less.

29. Apparatus for manufacturing a slide fastener wire or connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising two small-diameter pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, said rolls having a diameter of less than two inches and preferably having a diameter of only one inch or less, said rolls being synchronously rotated under high pressure and high torque by means including shafts, support bearings, and driving gears, all of which are substantially larger in diameter than the diameter of the pressure rolls, and sufficiently massive to provide such pressure between the rolls as to deform a uniform wire into the desired slide fastener wire in a single passage through the rolls.

30. Apparatus for the manufacture of slide fastener wire or a connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising small-diameter pressure rolls supported on sturdy large-diameter shafts, the shafts being in parallel relation and larger in diameter than the pressure rolls, and sufficiently massive to provide such pressure between the rolls as to deform a uniform wire into the desired slide fastener wire in a single passage through the rolls.

31. Apparatus for the manufacture of slide fastener wire or a connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising small-diameter pressure rolls supported on sturdy large-diameter shafts, the pressure rolls being mounted at adjacent ends of the shafts, and the shafts being parallel to one another and extending in opposite directions away from the pressure rolls, said rolls having a small diameter of the order of one inch and said shafts being sufficiently massive to provide such pressure between the rolls as to deform a uniform wire into the desired slide fastener wire in a single passage through the rolls.

32. Apparatus for the rolling of slide fastener wire, or a connected series of embryo slide fastener elements each having a projection and a recess, said apparatus comprising a frame, relatively large massive bearings mounted on said frame in approximately end to end relation but one being offset relative to the other, massive roll-support shafts in said bearings, said shafts extending in opposite directions and terminating

between the bearings, pressure rolls mounted in the ends of said large diameter shafts and arranged to be rolled in synchronism with one another by the shafts, one of said rolls having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, a countershaft extending through said frame offset from the bearings, gearing of generous proportions gearing said countershaft to said roll shafts, and means for driving the countershaft, said shafts and gearing being sufficiently massive to provide such pressure between the rolls as to deform a uniform wire into the desired slide fastener wire in a single passage through the rolls.

33. Apparatus for the rolling of slide fastener wire or a connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising a frame, relatively large massive bearings mounted on said frame in end to end relation, one being elevated slightly relative to the other, massive roll-support shafts in said bearings, said shafts extending in opposite directions and terminating between the bearings, small-diameter pressure rolls mounted in the ends of said large-diameter shafts and arranged to be rolled in synchronism with one another by the shafts, one of said rolls having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, a countershaft extending through said frame beneath the bearings, gearing of generous proportions gearing said countershaft to said roll shafts, and means for driving the countershaft, said shafts and gearing being sufficiently massive to provide such pressure between the rolls as to deform a uniform wire into the desired slide fastener wire in a single passage through the rolls.

34. Apparatus for manufacturing a slide fastener wire, or a connected series of embryo fastener elements, said apparatus comprising pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, means to support and synchronously rotate the rolls in mating registration, and a conveniently manipulatable self-locking precision adjustment means affording a very fine adjustment of the spacing between the rolls.

35. Apparatus for manufacturing a slide fastener wire, or a connected series of embryo slide fastener elements, said apparatus comprising pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, means to support and synchronously rotate the rolls in mating registration, conveniently manipulatable precision screw adjustment means affording adjustment of the spacing between the rolls, and a scale for indicating the movement of the adjusting screw.

36. Apparatus for manufacturing a slide fastener wire, or a connected series of embryo slide fastener elements, said apparatus comprising pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, the other having a periphery formed negatively to the other side of the slide fastener wire, means to support and synchronously rotate the rolls in mating registration, means affording axial movement of one of said rolls, a precision adjustment means for moving said roll in order to bring the rolls into axial registration, means affording transverse movement of one of the rolls in order to vary the spacing between the rolls, and a precision adjustment means for moving said roll to vary the spacing between the rolls.

37. Apparatus for the manufacture of a slide fastener wire, said apparatus comprising small-diameter pressure rolls supported at the adjacent ends of sturdy large-diameter shafts, one of said rolls having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, the shafts extending in opposite directions away from the pressure rolls and being carried in large massive bearings mounted on a base, a countershaft extending beneath the bearings, gearing of generous proportions outside said bearings for gearing said countershaft to said roll shafts, and precision screw adjustment means affording adjustment of the spacing between the rolls during operation of the apparatus.

38. A rolling mill for the manufacture of a slide fastener wire, or a connected series of embryo slide fastener elements, said mill comprising pressure rolls supported at the adjacent ends of sturdy large-diameter shafts, one of said rolls having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, the shafts extending in opposite directions away from the pressure rolls and being carried in large massive bearings mounted on a base, a countershaft extending collaterally of the bearings, gearing of generous proportions outside said bearings for gearing said countershaft to said roll shafts, means affording transverse movement of one of said bearings to vary the spacing between the rolls, readily manipulatable precision adjustment means for moving said bearing in order to adjust the spacing between the rolls, and a scale for indicating the movement of the adjustment means.

39. Apparatus for the manufacture of a slide fastener wire, said apparatus comprising small-diameter pressure rolls supported at the adjacent ends of sturdy large-diameter shafts, one of said rolls having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, the shafts extending in opposite directions away from the pressure rolls and being carried in large massive bearings mounted on a base, a countershaft extending beneath the bearings, gearing of generous proportions outside said bearings for gearing said countershaft to said roll shafts, and means affording vertical adjustment of the lower pressure roll in order to vary the spacing between the rolls, said means including horizontal trunnions for the bearing, precision screw adjustment means for supporting said bearing in desired position, and a scale for indicating the movement of the adjusting screw.

40. Apparatus for manufacturing a slide fastener wire, or a connected series of embryo slide fastener elements, said apparatus comprising pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire,

the other having a periphery formed negatively to the other side of the slide fastener wire, said rolls having tapered shanks, and means to support and synchronously rotate the rolls in mating registration, said means including sturdy, large-diameter shafts bored to receive the tapered shanks of the rolls, the shafts extending in opposite directions away from the pressure rolls and being carried in large, massive bearings mounted on a base, a countershaft extending collaterally of the bearings, gearing of generous proportions outside said bearings for gearing said countershaft to said roll shafts, means affording axial movement of one of said bearings, and a precision adjustment means for moving said bearing in order to bring the rolls into axial registration.

41. Apparatus for transforming a round wire into an element wire, or connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess and said embryo elements being disposed longitudinally of the wire and connected by a web of metal between the spread embryo jaws, said apparatus comprising two small-diameter pressure rolls having peripheries formed generally negatively to the desired element wire, the roll impressions at the head of the embryo element being such as to confine and shape the external configuration of the head, and the roll impressions at the embryo jaws of the element being such as to compress the wire at the middle to form the desired web and to squeeze the metal outwardly to form the embryo jaws, the roll impression around the embryo jaws being substantially enlarged in order to accommodate variations in the round wire stock.

42. Apparatus for transforming a round wire into an element wire, or connected series of embryo slide fastener elements, each of said embryo elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess and said embryo elements being disposed longitudinally of the wire and connected by a web of metal between the spread embryo jaws, said apparatus comprising two small-diameter pressure rolls having peripheries formed generally negatively to the desired element wire, the roll impressions at the embryo head of the embryo element being such as to confine and shape the external configuration of the embryo head, and the roll impressions at the embryo jaws of the embryo element being such as to compress the wire at the middle to form the desired web and to squeeze the metal outwardly to form the embryo jaws, the roll impression around the embryo jaws being substantially enlarged in order to accommodate variations in the round wire stock without causing changes in the pitch of the element wire, the maximum breadth of said element wire being defined, however, by side walls of the roll impression in order to keep the width of the element wire at the points of maximum breadth within a desired limit.

43. Apparatus for the manufacture of slide fasteners, out of a reel of preliminarily pressed wire, said wire being so pressed and thereby deformed as to form a connected series of embryo fastener elements, each of said embryo elements comprising an interlockable embryo head portion and divergent embryo jaws, said apparatus comprising a support for rotatably supporting said reel, means to intermittently feed the wire in a longitudinal direction, and means to successively sever the elements from the wire, said means including a die and a punch so shaped as to cut around the end of the head of the endmost element being severed, and at the same time to cut around the inside of the spread jaws of the next element in order to shape the entire inside surface of the jaws, in a single stroke of the punch

44. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to feed an element wire in longitudinal direction toward a tape extending transversely of the element wire, means to feed the tape longitudinally, a punch arranged for reciprocation in the direction of the tape at a point near the tape and transversely of the plane of the jaws of the element wire, said punch being so shaped as to shape the outline of the end of the head of the endmost element being severed from the element wire, and at the same time to cut around the inside of the spread jaws of the next element in order to properly shape the entire inside surface of the jaws, in a single stroke of the punch, and oppositely movable clamping jaws for clamping the jaws of an element on the beaded edge of the tape.

45. Apparatus for the manufacture of slide fasteners, out of a reel of preliminarily pressed wire, said wire being so pressed and thereby deformed as to form a connected series of embryo fastener elements, each of said embryo elements comprising an interlockable embryo head portion and spread embryo jaws, the embryo head of each embryo element being connected to the spread embryo jaws of the adjacent embryo element with the embryo elements arranged end to end and the embryo jaws pointing in the direction of the wire leaving the reel, said apparatus comprising a support on which said reel is rotatably mounted, means to intermittently feed the wire in a longitudinal direction, means to sever the endmost element from the wire, said means including a die and a punch so shaped as to cut around the end of the head of the endmost element being severed, and at the same time to cut around the inside of the spread jaws of the next element in order to shape the entire inside surface of the jaws, in a single stroke of the punch, means to intermittently feed a tape in a longitudinal direction, and means to clamp the jaws of the endmost element to the tape as it is severed from the wire.

46. Apparatus for the manufacture of slide fasteners, out of a reel of preliminarily pressed wire, said wire being so pressed and thereby deformed as to form a connected series of embryo fastener elements, each of said embryo elements comprising an interlockable embryo head portion and divergent embryo jaws, the embryo head of each embryo element being connected by means of a thin web of metal to the divergent embryo jaws of the adjacent embryo element with the embryo elements arranged end to end and the embryo jaws pointing in the direction of the wire leaving the reel, said apparatus comprising a support for rotatably supporting said reel, means to intermittently feed the wire in a longitudinal direction, means to punch away the thin web of metal in order to sever the endmost element from the wire, said means including a die and a punch so shaped as to cut around the end of the head of the endmost element being severed, and at the same time to cut around the inside of the spread jaws of the next element in order to shape the entire inside surface of the jaws, in a single stroke

of the punch, means to intermittently feed a tape in a longitudinal direction, and means to clamp the jaws of the endmost element to the tape as it is severed from the wire.

47. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to feed an element wire in longitudinal direction toward a tape extending transversely of the element wire, means to feed the tape longitudinally, a punch arranged for reciprocation in the direction of the tape at a point immediately adjacent the tape and transversely of the plane of the jaws of the element wire, oppositely movable clamping jaws for clamping the jaws of an element on the beaded edge of the tape, a counter, and a single cam shaft provided with appropriate cams for operating the wire feed means, the tape feed means, the punch, the clamping jaws, and the counter.

48. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to feed an element wire in longitudinal direction toward a tape extending transversely of the element wire, means to feed the tape longitudinally, a punch arranged for reciprocation in the direction of the tape at a point close to the tape and transversely of the plane of the jaws of the element wire, oppositely movable clamping jaws for clamping the jaws of an element on the beaded edge of the tape, and a single cam shaft provided with appropriate cams for operating the wire feed means, the tape feed means, the punch, and the clamping jaws, all of the aforesaid reciprocating parts being small and light and short in stroke, whereby the apparatus may be operated at exceedingly high speeds.

49. Apparatus for the manufacture of slide fasteners from an element wire comprising a connected series of embryo fastener elements, a feed dog to intermittently feed the element wire in a longitudinal direction, a check dog for preventing return movement of the wire, means to intermittently feed a tape in a longitudinal direction, means to sever the elements from the wire and to attach them to the tape, means for driving the feed dog, the tape feed means and the severing and attaching means, a counter, and means responsive to said counter for operating on one of said dogs and thereby making said combination of dogs unable to cause feed of the element wire, so as to produce a blank space between stringers.

50. Apparatus for the manufacture of slide fasteners, said apparatus comprising a reciprocable feed dog to intermittently feed an element wire in a longitudinal direction, a check dog for preventing return movement of the wire, means to intermittently feed a tape in a longitudinal direction, means to sever the elements from the wire and to attach them to the tape, means for driving the feed dog, the tape feed means and the severing and attaching means, a counter, and means responsive to said counter for moving the check dog out of engagement with the wire in order to interrupt the feed of the wire so as to produce a blank space between stringers, without necessitating interruption of the reciprocation of the feed dog.

51. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to feed an element wire in longitudinal direction toward a tape extending transversely of the element wire, means to feed the tape longitudinally, a punch arranged for reciprocation in the direction of the tape at a point close to the tape and transversely of the plane of the jaws of the element wire, oppositely movable clamping jaws for clamping the jaws of an element on the beaded edge of a tape, the means to feed the element wire comprising a feed dog the working end of which engages the wire at a point just ahead of and very close to the aforesaid punch.

52. Apparatus for the manufacture of slide fasteners, out of a heavy reel of slide fastener wire, or a connected series of embryo fastener elements, said apparatus comprising a support for rotatably supporting said reel, means to intermittently feed the wire in a longitudinal direction, means to sever the elements from the wire and to attach them to a tape, and means to maintain a loop of slack wire between the reel and the feed means, said means including a feeler to determine upper and lower limits for the loop of slack wire, an electric motor for rotating said reel in such direction as to unwind the wire, and switch means controlled by said feeler means for starting said motor when the slack reaches its upper position or minimum limit and for stopping said motor when the slack reaches its lower position or maximum limit.

53. Apparatus for manufacturing a slide fastener wire or connected series of embryo slide fastener elements, each of said elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess and said embryo elements being connected between the spread embryo jaws, said apparatus comprising pressure rolls, one of said rolls having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, and means to support and synchronously rotate the rolls in mating registration, said means including sturdy large diameter shafts, the shafts being parallel to one another and extending in opposite directions away from the pressure rolls, each of said rolls being formed integrally with a relatively long tapered shank having a threaded part at the small end thereof, the shafts having tapered holes dimensioned to matingly receive the tapered shanks of the rolls, and screw means for drawing the tapered shanks of the rolls axially into the shafts in order to secure the same rigidly in place.

54. Apparatus for manufacturing a slide fastener wire or connected series of embryo slide fastener elements, each of said elements having an embryo head with spread embryo jaws connected thereto, said embryo head having a projection and a recess, and said embryo elements being connected between the spread embryo jaws, said apparatus comprising pressure rolls, one having a periphery formed negatively to one side of the slide fastener wire, and the other having a periphery formed negatively to the other side of the slide fastener wire, means to support and synchronously rotate the rolls in mating registration, and a wire guide in the form of a finger having a wire guide passage extending longitudinally thereof, said finger being mounted in a position transverse of the plane of the shafts and extending toward the rolls to a point immediately adjacent the point of contact of the rolls with the wire.

GEORGE WINTRITZ.

CERTIFICATE OF CORRECTION.

Patent No. 2,201,068. May 14, 1940.

GEORGE WINTRITZ.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 8, for the word "or" read --of--; page 3, second column, line 63, for "serving" read --severing--; page 6, second column, line 66, for "bearing" read --bearings--; page 10, first column, line 22, before "precision" insert --micrometric--; page 11, first column, line 62, claim 10, for "rools" read --rolls--; page 12, second column, line 54, claim 21, strike out "of" before "jaws"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of July, A. D. 1940.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.

DEFENDANT'S EXHIBIT "M"

G. Sundback Patent No. 1,467,015

Filed July 10, 1919 Patented Sept. 4, 1923

[Note: Defendant's Exhibit "M"—G. Sundback Patent No. 1,467,015 is the same as Plaintiff's Exhibit No. 13 set out at page 1689 of this printed record.]

DEFENDANT'S EXHIBIT "N"

J. A. Murphy Patent No. 1,664,480

Filed July 27, 1923 Patented April 3, 1928

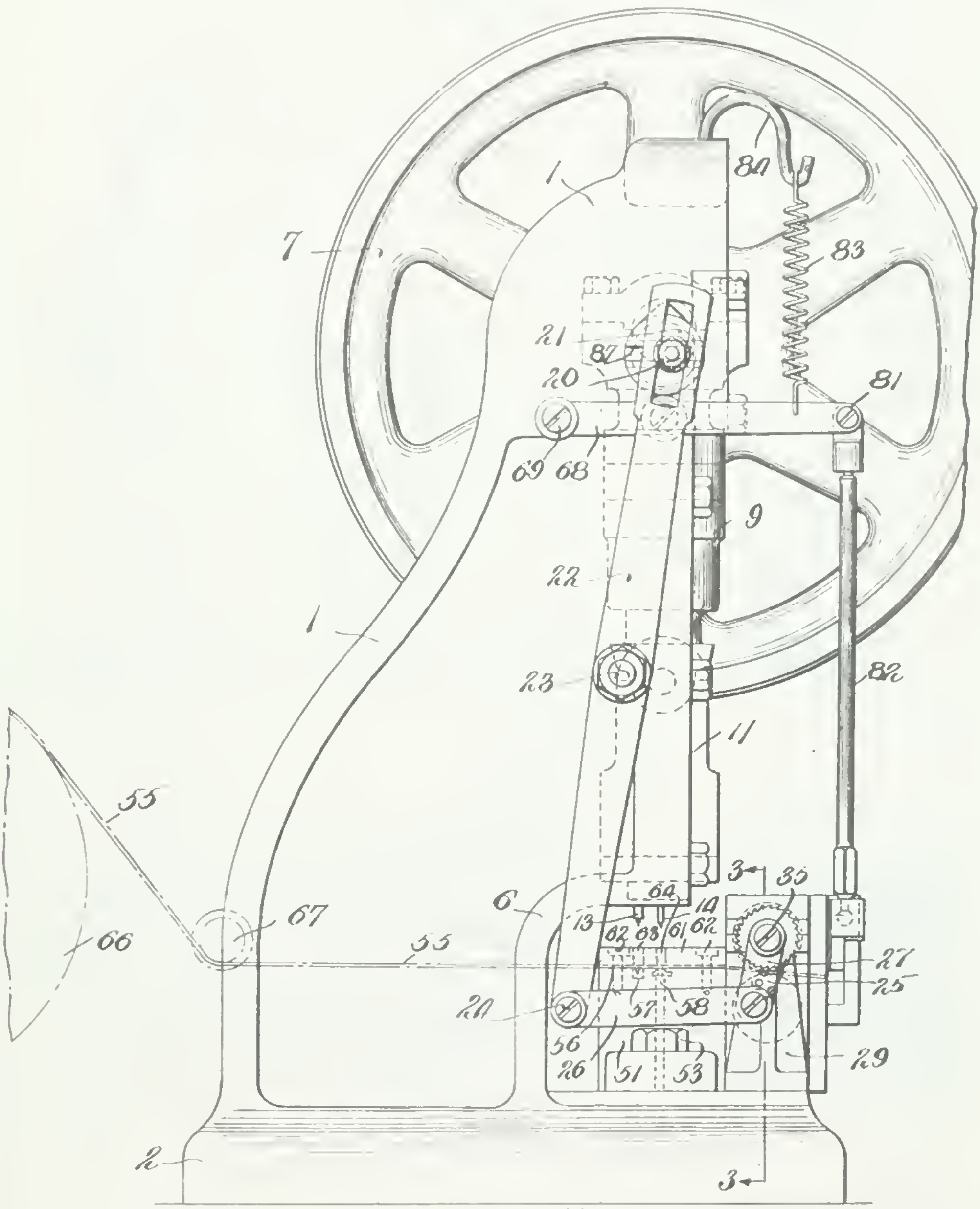
April 3, 1928. 1,664,480

J. A. MURPHY

MANUFACTURE OF PRIMER ANVILS

Filed July 27, 1923 3 Sheets-Sheet 1

Fig. 1



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April 3, 1928. 1,664,480

J. A. MURPHY

MANUFACTURE OF PRIMER ANVILS

Filed July 27, 1923 3 Sheets-Sheet 2

Fig. 2

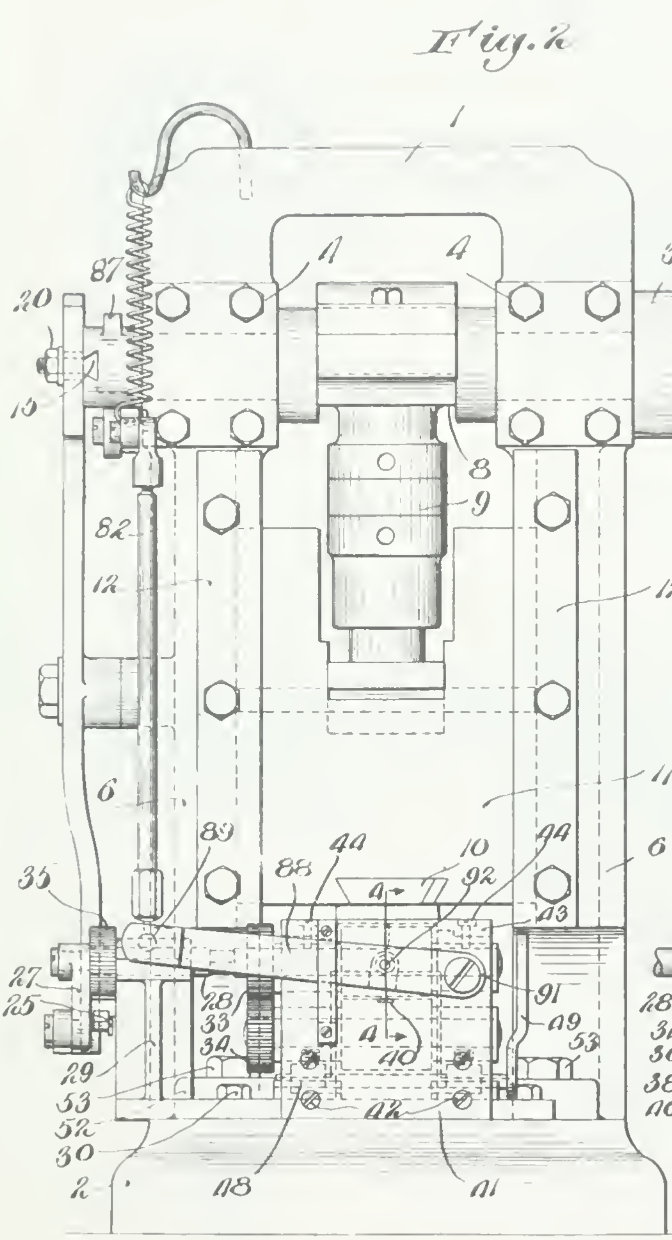
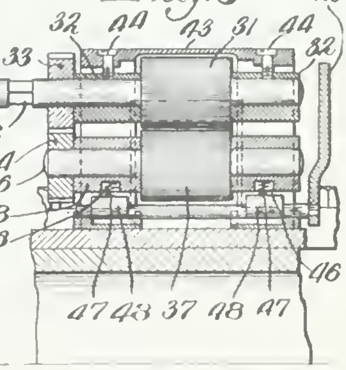


Fig. 3



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MANUFACTURE OF PRIMER ANVILS

Filed July 27, 1923 3 Sheets-Sheet 3

Fig. 4

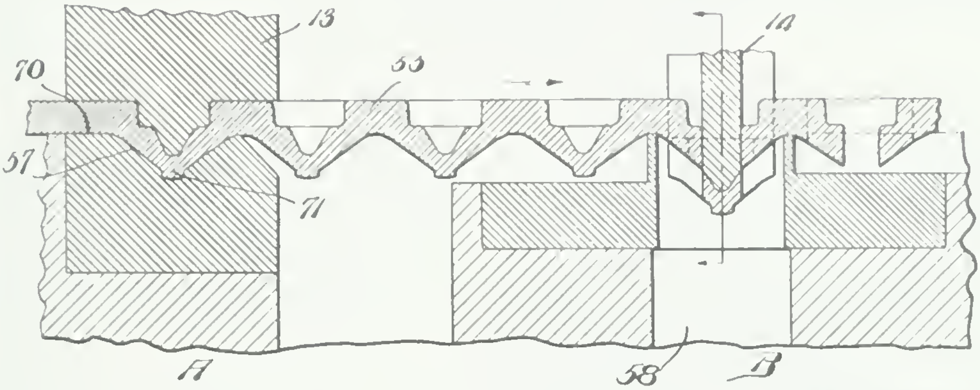

Fig. 5

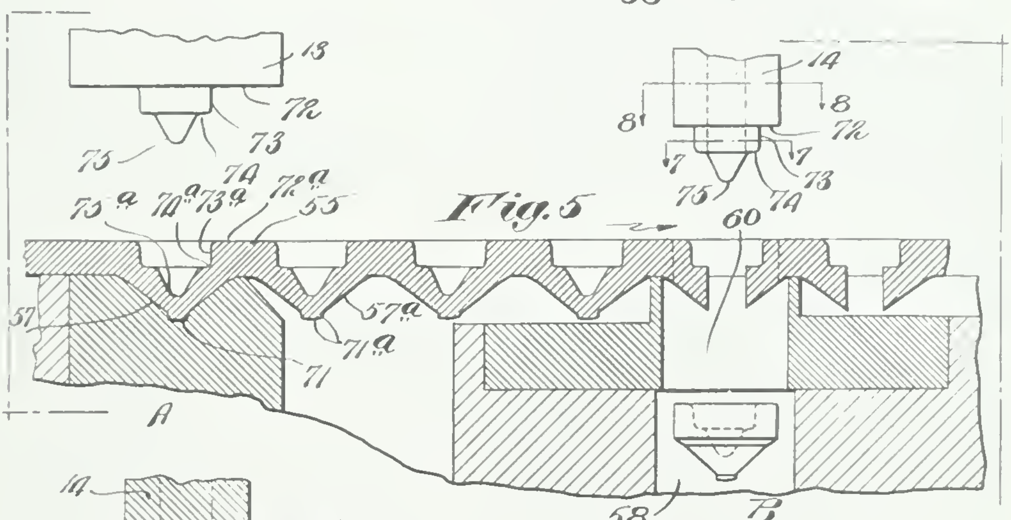

Fig. 6

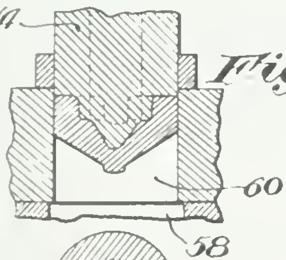

Fig. 9

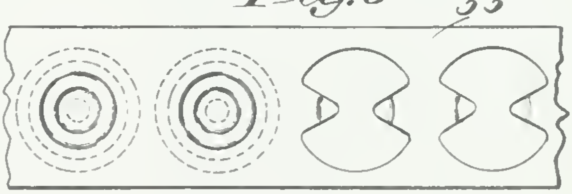

Fig. 8

Fig. 7

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Patented Apr. 3, 1928. 1,664,480

UNITED STATES PATENT OFFICE.

JAMES A. MURPHY, OF LOWELL, MASSACHUSETTS, ASSIGNOR TO UNITED STATES CARTRIDGE CO., OF LOWELL, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

MANUFACTURE OF PRIMER ANVILS.

Application filed July 27, 1923. Serial No. 654,171.

In the manufacture of primer anvils, and more especially anvils having the shape and properties, such as described in my copending application, Sr. No. 654,170, filed on even date herewith, it is desirable that the operations involved shall be effected automatically, and it is accordingly an object of my invention to provide a machine for this purpose.

It is a feature of my invention that with my machine each individual anvil is made by a two stage operation upon a thin strip or sheet of malleable metal.

A preferred embodiment of my invention is described below, reference being made to the accompanying drawings, in which:

Fig. 1 represents a side elevation of the machine;

Fig. 2 represents a front elevation of the machine; and

Fig. 3 represents a detail cross-section on the plane indicated by the line 3—3 of Fig. 1.

Fig. 4 is a cross-section of a metal strip, and separate punching blocks in the plane of line 4—4, Fig. 2, showing the punches in lowered position;

Fig. 5 is a cross-section, the same as Fig. 4, the punches being in elevated position;

Fig. 6 is a detail cross-section of the extruding punch in direction of the arrows 6—6 in Fig. 4;

Fig. 7 is a cross-section of the extruding punch in the direction of arrows 7—7 of Fig. 5;

Fig. 8 is a cross-section of the extruding punch in the direction of the arrows 8—8 of Fig. 5; and

Fig. 9 is a plan view of a portion of the metal strip 55 shown in Fig. 5.

The yoke 1 is mounted upon the base 2 and supports the shaft 3 in the bearings 4. Said bearings are supported by the uprights 6 also mounted on the base 2. On the outer end of shaft 3 is the driving pulley 7 while between the bearings 4 is the eccentric bearing 8 to which one end of piston 9 is pivoted, the other end being pivoted to the vertically slidable head 11 mounted in the guides 12 on the uprights 6. Said head 11 is provided on its under face with a dovetail groove 10 in which may be mounted the embossing punch 13 and punch 14.

In a slot 15 on the end of shaft 3 opposite to the driving wheel is mounted the adjustable offset bolt 20 slidably engaging a slot 21 in a lever 22 which is pivoted to the upright 6 at 23 and at 24 to one end of arm 26, the other end of which is pivoted to an arm 27. Said arm 27 carries a pawl 25 and is pivoted to the end of a shaft 28, carrying a ratchet wheel 35 and bearing in the upright 29 fastened by nut 30 on base 2.

Said shaft 28, on the opposite side of upright 29, is provided with a corrugated roller 31 between bearings 32 mounted on either side of said roller, and with a gear 33. Said gear 33 meshes with a similar gear 34 on the shaft 36 of a similar roller 37, adjacent to said roller 31, and mounted on bearings 38.

The bearings 32 and 38 and their respective rollers 31 and 37 are resiliently urged toward each other by virtue of the arrangement to be described. Vertical plates 41 are fixed to the base 2 by means of screws 42 and joined together at the top by a horizontal plate 43. Passing through plate 43 are set screws 44 which press downward upon the bearings 32 while compression springs 46 set into recesses 47 in the under side of bearings 38, and operated by cams 48 and hand lever 49, tend to force bearing 38 upward. Thus the rollers 31 and 37 are yieldingly urged toward each other by a force depending upon the springs 46 and the positioning of the cams 48 thereagainst.

Said rollers are mounted forward of the block 51 which rests on base 2 clamped thereto by the boss 52, and bolts 53. Said block is provided with a horizontal slot 56 in the plane of contact of rollers 31 and 37, and adapted to receive a strip of metal 55 and to pass it between said rollers and to guide it beneath punch 13 and punch 14 in the head 11. In the bottom surface of said slot 56 is the depression 57 adapted to cooperate with the punch 13 in shaping said strip, and an aperture 58 adapted to register with and receive the punch 14 and to permit the piece of metal cut out by it to drop therethrough.

This part of the construction is more clearly illustrated by Figs. 4 and 5 in which the die block is represented in two units A and B, the metal strip 55 being adapted to move intermittently in the direction of the arrow. Thus, a given portion of the strip will first come to rest over block A which has a flat top 70 with an inverted cone shaped depression 57 (the apex of which is enlarged into a cylindrical depression 71) in registry with embossing punch 13, and coacting therewith to shape said metallic strip as shown by Fig. 4. It is to be noted that said punch 13 has a flat surface 72, parallel with the flat top 70 of block A, a cylindrical surface 73, a flat surface 74, and an ovoido-conical point 75 opposite to the cylindrical depression 71 in depression 57, and shaping the corresponding surfaces 72^a, 73^a, 74^a, 75^a, 71^a, and 57^a respectively, on the metal strip 55. Adjacent block A, and at a given distance therefrom in the direction of the arrow is block B (block A and block B being represented by a single block 51 in Fig. 1) with a vertical aperture 58 therethrough, having the same cross section as the anvils to be made, and in registry with the extruding punch 14. The face of said punch 14 has surfaces identical in contour with those of punch 13 and which are numbered the same, but of a cross section as shown in Figs. 8 and 9, to correspond with the plan view of the anvils to be cut out. Likewise the entrance 60 to aperture 58 is of such a size and so shaped that said punch 14 will just fit it, producing a shearing action therewith to cut the strip 55 between them.

The block 51 may, as shown in Figs. 1 and 2, or may not as in Figs. 4 and 5, be covered by a cap plate 61, affixed to the die block by machine screws 62 and provided with openings 63 and 64 for the passage therethrough of the punch 13 and punch 14 respectively.

In operation, the strip of metal 55 is drawn from roller 66 passed under the guide roller 67, through slot 56 in the die block and thence between rollers 31 and 37 by which it is gripped under tension of the springs 46, and intermittently drawn forward a definite distance by each operation of the pawl 25 on the ratchet wheel 35.

After thus feeding in the end of the metal strip, power is applied, as by a belt to the pulley 7, and, upon consequent rotation of the shaft 3, the head 11 is lowered, forcing embossing punch 13 against the portion of the metal strip 55 immediately beneath it (imparting its contour to the upper surface and the contour of the depression 57 to its lower surface) and then lifting it clear of the strip entirely. Concurrently, the punch 14 is forced against a portion of the strip previously shaped by the punch 13 and by its shearing action against the edges of the aperture 60, cuts vertically through the strip, removing a corresponding section of the embossed portion therefrom.

It will be apparent that the metal strip when so acted upon by punch 14 will not only be bent but molded into the desired shape and contour between the surfaces 72, 73, 74, 75, 57 and 71 providing it with the corresponding surfaces 72^a, 73^a, 74^a and 75^a on the upper side and 57^a and 71^a on the lower side. Not only so, but these surfaces will meet in sharply defined edges, which is exceedingly important,—especially between 72^a and 73^a and between 71^a and 57^a for example. Moreover, as a result of the difference in conical angle between the ovoido-conical point 75 and the conical depression 57, the thickness of the strip will be modified and decreased toward the top providing the space enclosed by surface 75^a.

By suitable adjustment of the offset bolt 20, it will, upon rotation of the shaft 3, operate the levers 22, 26 and 27, and pawl 25, and thereby push the ratchet wheel 35 forward, driving the corrugated roller 31 a given amount and this, in turn, draws the strip 55 forward the same distance. This distance is such that the portion of the strip 55 embossed by the die 13 will be brought into registry with the punch 14 and aperture 58 by an integral number of operations substantially equal to the ratio of the distance between the two to the length of the embossed portion of the strip.

Moreover, this advancement of the metal strip is performed alternately with the strokes of the punch 13 and punch 14, and after it has become disengaged from them. This is determined by the relative angular position of the offset bolt 20 and of the eccentric bearing 8 upon shaft 3.

Thus after die 13 has embossed one portion of the strip, it is raised, the strip advanced and the portion embossed by 13 subsequently registers with the punch 14 and upon the descent of the die-head 11 punch 14 completes the operation by cutting out the embossed portion. As above pointed out, this registry may take place upon the next or after any integral number of progressions of the metal strip, depending upon the distance between die 13 and punch 14 and the amount by which it is advanced.

In this operation, the shape of the punch 14 is preferably such that it will exactly coincide with the surfaces 72^a, 73^a, 74^a, 75^a which have been formed upon the corresponding portion of the strip 55. This not only serves to bring the strip more accurately concentric with the punch, but assures a perpendicular cutting action by the punch as it forces this portion of the metal into the entrance to the aperture 58.

The cut out portion of the strip falls through the aperture 58 and the remainder of the strip continues between rollers 31 and 37 which continue to draw it through the die as already described. In view of the fact that primer anvils are of relatively small dimensions, it is not necessary to lift the molded strip in order to permit its continued passage through the machine. The strip is sufficiently flexible to lift under the tension employed in drawing it through the guide slot and the tapered depression in its under surface of itself tends to raise it from its position in the die after the molding operation.

As a safety device to further insure the registry of the embossed portion of the strip with punch 14, there may be provided the lever arm 68 pivoted at 69 to the yoke 1 and at 81 to the vertical rod 82 and drawn upwardly by spring 83 suspended by hook 84 from yoke 1. Said lever arm is operated by contact with the cam 87 mounted upon shaft 3, forcing it downwardly against the tension of spring 83. At its lower end rod 82 is pivoted at 89 to arm 88, said arm 88 is also pivoted to plate 41 at its opposite end 91 and carries a knife edge 92 adapted to bear against plate 41 and when in lowered position to close the aperture 40 therein, cutting off the protruding end of the strip 55.

By this device it will be apparent that with proper adjustment of the cam 87, the tongue 92 will be lowered over the opening 40 at that period in the rotation of shaft 3 when the punch 13 and punch 14 are in registry with the proper portions of the strip 55 and are in the act of impressing and punching it. It will also prevent any forward movement of the strip which may be induced by the shaping operation or by excessive action of the rollers 31 and 37 in drawing the strip through the die. This device is, however, supplemental to my invention and not indispensable to it, for with the rollers properly adjusted, the advance of the strip will be exact and while at rest, they will hold it firmly. In this latter case, the metal strip is of course not cut off and is in the form of a continuous ribbon as it leaves the machine through the slot 56.

With each downward stroke of the head, a previously shaped anvil (or plurality of anvils) is removed from the strip of metal by a positively acting mechanism, and another anvil is shaped. Both results are effected by the same stroke, and simultaneously, but any given portion of the metal strip is shaped first and then cut from the strip. Preferably the shaping and cutting operations are conducted in this order and may be effected with an extreme degree of rapidity but concurrent action upon the same portion of the strip at the same time is to be avoided. If the metal were bent subsequent to cutting, the cut edge and surface would be deformed, thus rendering the anvils produced of irregular shape and defeating the purpose of this invention.

By completing the bending or shaping action upon the metal, while it is in sheet form, and then cutting to the desired shape, the contours of the anvil are not altered or affected by the cutting action, but are in fact reinforced during the cutting action which leaves the cut edges accurate both as to size and shape.

The advantages of my device rest not only in the simplicity of design and easy operation of the mechanism involved, but also in its adequate functioning to produce a primer anvil having the desirable properties set forth in my co-pending application above referred to, but may also be adaptable for other comparable products which are required to meet these or similar conditions of shape or use. It is to be noted that such other modifications or adaptations of my invention are comprehended by the above specification and included in the following claims.

I claim:

1. A machine for making primer anvils comprising means for advancing a sheet of metal therethrough, means for shaping a portion of said sheet into a hollow cone, the outer and inner surfaces of which having different conical angles, and means for cutting the portion so shaped from the metal sheet.

2. A machine for making primer anvils comprising means for advancing a sheet of malleable metal therethrough, means for shaping a portion of one side said sheet to an ovoido-conical contour and the corresponding portion of the opposite side of said sheet to the conical contour of the primer anvil, and means for subsequently cutting the shaped portion from the sheet.

3. A machine for making primer anvils comprising a punch having a conical point and a die block having a conical depression, in registry with and of a less acute conical angle than that of the conical point of said punch, and means for advancing a sheet of malleable metal intermittently past the punch and die block, said last named means operating when the punch is in raised position.

4. A punch for stamping out primer anvils having end surfaces adjacent its cutting edge which are approximately perpendicular to its axis, and a tapered projection inside said surfaces, the periphery of the base of said projection being more nearly parallel with the axis of the punch than the periphery of the tip of the projection.

5. A machine for making primer anvils comprising means for feeding a sheet of metal lengthwise along a predetermined path, punch and die members on opposite sides of said path for shaping succeeding portions of said sheet into hollow tapered contour, one of said members moving back and forth transversely of the plane of said sheet, and other punch and die members dis-

posed farther along said path for cutting the anvils from the sheet, the latter punch member having end surfaces extending transversely of the axis of the punch immediately inside its cutting periphery and a tapered protuberance inside said surfaces.

6. A machine for making primer anvils comprising means for feeding a sheet of metal lengthwise along a predetermined path, punch and die members on opposite sides of said path for shaping succeeding portions of said sheet into hollow cone shaped contour, one of said members moving back and forth transversely of the plane of said sheet, and other punch and die members disposed farther along said path for cutting the partially formed anvils from the sheet, the latter punch member having a conical central portion and outer end surfaces approximately perpendicular to the axis of the punch, said surfaces terminating at the peripheral cutting edge of the punch.

7. A machine for making primer anvils comprising a cone-shaped punch, a die block having a conical depression in registry therewith, said punch and die block being adapted to shape between them a metal sheet, and means for cutting the portion so shaped from said sheet.

8. A machine for making primer anvils comprising a conical punch, a die block in registry therewith having a conical depression, adapted to press and shape between them a sheet of metal and an extruding punch adapted to cut a section of the metal so shaped from said sheet perpendicularly thereto.

9. A machine for making primer anvils comprising a conical punch and a die block having in registry therewith a conical depression, adapted to press and shape between them a portion of a sheet of metal and an extruding punch having a point of the same contour as said conical punch and adapted to cut a section of said shaped portion from the sheet perpendicularly thereto.

10. A machine for making primer anvils comprising a punch with an ovoido-conical point and an annular shoulder at its base, a die block having in registry with said punch a conical depression with a cylindrical surface at its base and apex, said punch and die block being adapted to press and shape between them a sheet of metal, and an extruding punch having an ovoido-conical point and an annular shoulder at its base, and adapted to register with a corresponding aperture in the die block and with a shaped portion of said metal sheet and to cut from the latter a right-cylindrical section with longitudinal grooves therein.

11. A machine for making primer anvils from sheet metal comprising means to shape a portion of said metal to the desired cone-shaped contour and a punch having a point of such size and shape as to exactly fit said cone-shaped portion of the sheet and to cut a section therefrom perpendicularly to said sheet.

12. A machine for making primer anvils comprising a die block, a pair of rollers engaging between them a strip of malleable metal and adapted to intermittently advance said strip a given distance through a slot in the die block and an edge, movable over the exit end of said slot, operated alternately with the advancing period of said rollers to provide a definite period during which said strip shall be held stationary.

13. A machine for making primer anvils comprising a die block, a feeding device for intermittently advancing a malleable metal strip longitudinally for a given distance through a slot in the die block, a knife edge movable over the exit end of said slot alternately with the period of advance of the metal strip, to cut off and arrest its progress, and an embossing and punching die adapted to operate upon different portions of said strip while it is stationary.

14. The process of making primer anvils for explosive shells comprising shaping two sides of a thin sheet of metal to different conical contours and cutting from said sheet a substantially cylindrical section containing said shaped portion.

15. The process of manufacturing anvils for cartridge primers comprising the steps of indenting a sheet of malleable metal to a desired truncated-conical contour and cutting from said sheet the section containing the portion so shaped.

16. The process of making primer anvils for explosive shells, comprising pressing one side of a thin malleable metal sheet into a truncated-conical depression and the other side over a cone, and cutting the portion so shaped from the sheet by a concentric cylindrical punch.

17. A process for the manufacture of a primer anvil for explosive shells comprising the steps of pressing a sheet of malleable metal into the shape of a hollow cone, with a boss at its exterior apex, a cylindrical surface adjacent the base of said cone, a flat surface substantially at right angles to the axis of said cylindrical surface, and cutting the portion so shaped from the metal sheet.

18. The process of making primer anvils for explosive shells comprising simultaneously indenting one side of a metal sheet to form a cone-shaped point provided with an annular shoulder at its base, and forcing the corresponding opposite side of said sheet into a conical shape having an enlargement at its apex and at its base and subsequently cutting from said sheet a substantially right-cylindrical section including the portion so shaped.

19. A process for the manufacture of a

primer anvil for explosive shells, comprising the steps of first indenting one side of a sheet of malleable metal to form a cone shaped point provided with an annular shoulder, simultaneously compressing the opposite side of said sheet into a concentric conical form having at the apex and base of said form cylindrical enlargements, and secondly cutting from said metal sheet the portion so shaped and diametrically opposite notches from the margin thereof.

Signed by me at Lowell, Massachusetts, this 20th day of June, 1923.

JAMES A. MURPHY.

DEFENDANT'S EXHIBIT "O"

S. Loew Patent No. 2,444,706

Filed Aug. 12, 1944 Patented July 6, 1948

July 6, 1948. S. LOEW 2,444,706

SLIDE FASTENER MACHINE

Filed Aug. 12, 1944

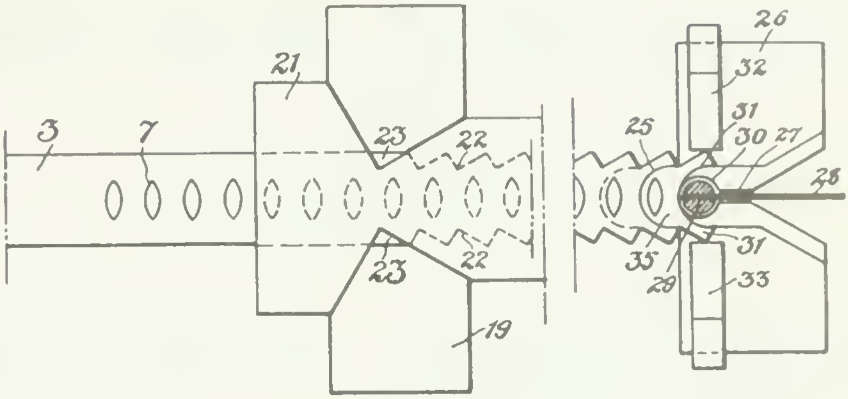


Fig.1

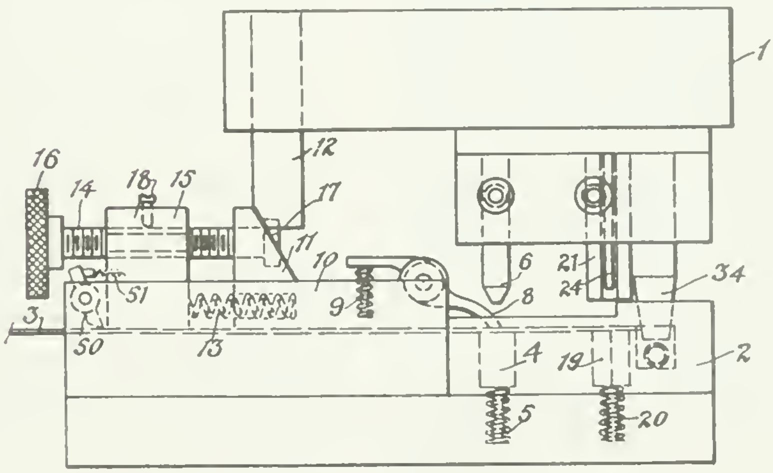
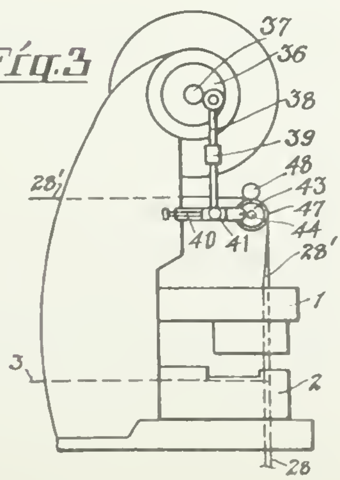


Fig.2

Fig.3



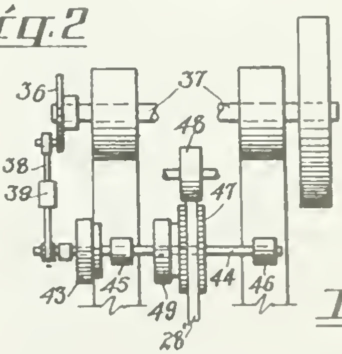


Fig.4

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UNITED STATES PATENT OFFICE

2,444,706

SLIDE FASTENER MACHINE

Sigmund Loew, Windsor, Ontario, Canada

Application August 12, 1944, Serial No. 549,236
In Canada July 25, 1944

5 Claims. (Cl. 153—1)

1

This invention relates in general to machines for the manufacture of slide fasteners, and more particularly to automatic machines for the manufacture of slide fastener stringers from which the finished slide fasteners are made.

The primary object of this invention is to provide a single machine for the complete manufacture of slide fastener stringers, wherein the operation is continuous.

Another object is to provide an improved machine for making slide fastener elements from stock wire with a minimum of waste.

Still another object is to provide greater precision in the attachment of the slide fastener elements to the stringer tape.

It is also an object of this invention to provide a slide fastener stringer of more durable construction.

Still another object is to reduce cost of operation in the manufacture of slide fastener stringers.

The foregoing objects together with others will be apparent from the following description considered in connection with the drawing in which:

Figure 1 shows a plan of the more important stages of operation.

Figure 2 shows an elevation of the main part of the machine.

Figure 3 is a diagram of the general arrangement of the machine in combination with a standard power press of which it is a part, and

Figure 4 is a front elevation of the spacer mechanism for spacing the fastener elements on the tape.

The machine as shown in the drawings, consists of an upper die 1 and a lower die 2. The stock wire which is flat is fed into the lower die 2 as shown at 3. When the wire 3 reaches the first station in the die 2 it is immediately over a forming die 4 which is supported on a spring or a plurality of springs 5. A punch 6 which is located in the die 1 constitutes the upper part of the die 4 so that when the die block 1 comes down, a cavity 7 is formed in the wire, generally of the shape shown in Figure 1. This cavity will hereinafter be referred to as the embryo.

The upper die 1 and lower die 2 are used in combination with a press. The upper die block is attached to the pitman of the press and the lower die block is fixed to the table of the press.

The lower die block 2 is provided with a reciprocating finger 8 which is pressed against the wire 3 at the point where cavity 7 has been formed, by means of a spring 9. The finger 8 is pivotally attached to a movable section 10

2

which is part of the die block 2. The section 10 is provided with a cam 11, and the die block 1 is provided with a corresponding cam 12. When the die 1 comes down to punch the embryo 7, the cam 12 slides against the cam 11 thus pushing section 10 with its attached finger 8 out of the way of the descending punch 6. When the punching operation of 6 is completed, the die 1 ascends allowing section 10 to move forward due to the action of spring 13. The finger 8 moves forward with the section 10. The point of the finger 8 is made so that it fits into the embryo 7, so that when the finger moves forward it pulls the wire 3 along with it so that the wire is advanced a predetermined distance. The distance the wire is advanced is determined by the following arrangement. A threaded bolt 14 is screwed into a tapped block 15 which is part of the die 2. One end of this bolt is provided with knurled head 16, and the other end of the bolt is provided with a stop 17. The cam 11 is bored with a hole to permit the passage of the bolt 14, but said hole is small enough to prevent the passage of the stop 17, so that by adjusting the length of the bolt 14 between the block 15 and the cam 11, the movement of the section 10 and the finger 8 is determined. A setscrew 18 locks the bolt 14 into position.

A plurality of embryos 7 are punched in the wire before said wire reaches the next stage of operation. At this stage the wire passes between a lower punching die 19 which is supported on a spring 20, and an upper die 21 which is part of the die block 1. An enlarged diagram of this set of punching dies is shown in Figure 1, where the action between the die 19 and the die 21 punches out a serration 22 on either side of the wire 3. The punched scrap 23 is blown away by means of compressed air through the pipe 24 which is situated in the grooved part of the die punch 21. The die 21 is also provided with a semi-circular cutting edge for the purpose of cutting out a semi-circular section as shown at 25, the use of which will be described in connection with the final stage in the making of the slide fastener stringer.

The final stage in the operation of the machine may be more fully comprehended by reference to both Figures 1 and 2. The lower die block 2 is also provided with a guiding block 26 which has a slot 27 for guiding the stringer tape 28. As this tape is usually finished on one of its edges with a pair of rounded cords 29, a circular guide 30 is also provided in the block 26 to accommodate the said cords. When the wire 3 reaches the position where the cord 29 nests within the died out section 26 which forms the inner wall of the element, the jaws 31 become located between two opposite clamping hammers 32 and 33. The die 1 is provided at this point with a pair of cams 34, 34. On the downward stroke of the die 1 the cams 34, 34 compress the hammers 32 and 33 against both sides of the element jaw 31 so that the element becomes permanently clamped to the tape 28 at its corded edge.

Throughout this entire operation the individual element as indicated by 31 remains an integral part of the wire 3, and only after the jaws have been clamped onto the tape, the element 35 is severed from the wire 3 along the line 25 by the die 21. This of course gives greater stability to the individual element than is provided in existing machines where such elements are individually and separately attached to the tape, thereby providing a greater degree of precision to the spacing of the elements on the tape.

The tape 28 is fed into the machine in a vertical position. It is held stretched to the required degree of tension between the reel on which it is originally wound and a spacing mechanism such as is shown in Figures 3 and 4. To an eccentric wheel 36 which is attached to the press shaft 37, is pivotally attached an arm 38 whose length is adjustable by means of a turnbuckle or some such mechanism 39. The arm 38 is also pivotally attached to a horizontal arm 40, the bearing at this point being on a movable block 41 for the purpose of adjusting the location of this bearing along the arm 40. One end of the arm 40 is eccentrically attached to a friction clutch 43. Shaft 44 is supported by bearings 45 and 46 which are in turn supported by the walls of the press. A knurled wheel 47 is mounted on the shaft 44 in a position above the guide block 29. The tape with the fastener elements attached thereto which will now be referred to as 28' rolls over the wheel 47 and is held tightly pressed against the knurls by an upper wheel 48. The wheel 47 is attached to the shaft 44 by means of a friction clutch 49 which is directly attached to the shaft 44, and the clutch 43 is similarly attached to the said shaft. The clutches 43 and 49 are so arranged as to provide rotation to the shaft 44 in one direction only so that one stroke caused by the eccentric 36 turns the shaft 44 while the return stroke has no effect upon said shaft. Thus an intermittent movement is imparted to the tape, the intermissions providing the proper spacing to the fastener elements 36.

In actual practice the machine operates in the following manner, although it is not intended thereby to limit this invention to the specific figures which follow. The flat wire is fed into the die and is moved forward by the reciprocating finger pushing on the embryo which has been drawn in an inverted position in the first station of the die. After the wire has fed forward twenty-seven times it is now in a position for the notching dies to function. These also are inverted with the male die being in the lower portion. At this point the only blanking out of the entire process takes place, and the wire leaving this point has the embryo formed therein and serrated edges. The strip continues to be fed forward so that it now lays on the die which blanks the element off the strip of wire. In order that the element that is to be cut off be held stationary while it is being attached to the tape, the upon the tape takes place before the shearing off of the element is completed. In order that the element remain on top of the blanking die, the wire which is progressing through the die has to go down under the blanking punch, notching punch, and the impresseion punch. These punches are all the same length and therefore carry the wire down evenly, while the wire is thus going down it is supported by spring loaded pads which on the upward stroke of the press return to their normal level. The entire procedure is intermittently repeated.

The machine is also provided with a catch 50 in the lower die block 2 at the entrance of the stock wire. This catch is pressed against the stock wire by a spring 51. The catch is at an angle leaning away from the direction in which the wire 3 travels, so that the sharp edge of the said catch prevents the wire from backing out of die.

It is obvious that changes might be made in nonessentials of the structure of the machine while retaining the essentials of the invention and I do not consider it limited to the specific construction shown; therefore what I claim is:

1. An automatic machine for the manufacture of slide fastener stringers in combination with a press, comprising an upper die block which is attached to the pitman of the press and a lower die block which is fixed to the table of the press, a series of upper and lower dies or punches for successively drawing an embryo cavity, serrating the edges, and punching off individual elements from a stock wire, means for clamping said elements to a standard tape, and means for feeding said stock wire to the successive stages in the operation comprising a sliding section which is part of the lower die block, a reciprocating finger which pushes the stock wire by engaging the embryo cavity and which is part of said sliding section, a spring in compression which presses against one end of said finger to provide engagement between the finger and embryo in the stock wire, a cam in the upper die block which engages a corresponding cam on said sliding section which retains the reciprocating finger, a compression spring between said sliding section and a fixed part of the lower die block, reciprocating motion being provided by the action of said cam and spring, and means for controlling the extent of said motion including a threaded bolt which limits the motion of the sliding section imparted by the cam on said sliding section.

2. A machine for the manufacture of slide fastener stringers comprising in combination upper and lower die blocks for relative movement toward and from one another with reciprocating motion, punch and die means carried by the respective die blocks and operable with each reciprocation of the die blocks to form an embryo cavity in flat stock wire positioned between the die blocks, apparatus for feeding the stock wire forward including a finger that slides back and forth lengthwise of the flat stock wire with each reciprocation of the die blocks and in constant contact with the stock wire and against metal displaced by the operation of the punch and die that form the embryo cavity, finger-supporting and reciprocating mechanism carried by one die block, abutment means carried by the other die block in position to operate said mechanism for moving the finger with each reciprocation of the die blocks, and other die means carried by the die

one end of a slide fastener element, and for cutting off the end portion of the wire stock to complete the slide fastener element after the element is in position astride a tape.

3. An automatic machine for the manufacture of slide fastener stringers including in combination a press, an upper die block attached to the pitman of the press and a lower die block fixed to the table of the press, a series of cooperative punches and dies carried by the die blocks for successively forming an embryo cavity, shaping the edges, and punching off individual elements from a stock wire after said elements have been successively advanced to positions astride a tape, clamping mechanism carried by one of the die blocks for clamping individual elements to the tape, deciprocating feeding mechanism carried by one of the die blocks for feeding the stock wire with a step-by-step motion past the successive dies and punches and to said clamping means, abutment means on one of the die blocks for operating the clamping mechanism and the feeding mechanism carried by the other die block with each stroke of the press, a spring for returning the feed mechanism after each stroke, a finger comprising a part of the feeding mechanism with an end portion that engages metal displaced by the forming of the endmost embryo cavity, and means for holding said end portion of the finger in contact with the stock wire.

4. A machine for the manufacture of slide fastener stringers comprising in combination with a press, a reciprocating finger operated by the movement of an upper die block connected to the pitman of the press for intermittently feeding the stock wire from which slide fastener elements are made, upper and lower die combinations for punching embryos in the stock wire, a notching die adjustably attached to the upper die block and a complementary notching die in a lower die block supported by a compression spring, the upper and lower notching dies being for the purpose of serrating or notching the edges of the stock wire to form the outer contour of the jaw of the fastener element, said die combinations also including means for shearing off the individual fastener elements from the rest of the stock wire after each of said elements has been brought into a position astride a standard slide fastener tape, and means for attaching the elements to the standard slide fastener tape.

5. A machine for the manufacture of slide fastener stringers comprising in combination with a press, a reciprocating finger for feeding stock wire, dies for drawing embryos in said wire, dies for forming the edges of said wire and punching the individual fastener elements from the said stock wire, means for clamping the said elements to standard stringer tape, and means to feed the tape to space the fastener elements thereon including a shaft which is supported from the walls of the press above the upper die block, a knurled wheel mounted on said shaft by means of a friction clutch, a second friction clutch which is attached to the end of the shaft, an oscillating arm which is attached eccentrically to the second friction clutch and operatively attached at its other end to said main shaft, and a connecting rod between the said eccentric on the press shaft and the osculating arm, so that upon the rotation of the press shaft an intermittent motion in one direction is imparted to the spacer shaft and the knurled wheel thereon, and to the slide fastener stringer between the said knurled wheel and a pressure wheel provided for that purpose.

SIGMUND LOEW.

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DEFENDANT'S EXHIBIT "AM-3"

D. Silberman Patent No. 2,437,793

Filed Sept. 23, 1944 Patented March 16, 1948

[Note: Defendant's Exhibit "AM-3"—D. Silberman Patent No. 2,437,793 is the same as Plaintiff's Exhibit No. 3 set out at page 1664 of this printed record.]

DEFENDANT'S EXHIBIT "BF"

G. Sundback Patent No. 1,434,857

Filed Oct. 19, 1918 Patented Nov. 7, 1922

G. SUNDBACK.
MAKING FASTENERS.
APPLICATION FILED OCT. 19, 1918.

1,434,857.

Patented Nov. 7, 1922.
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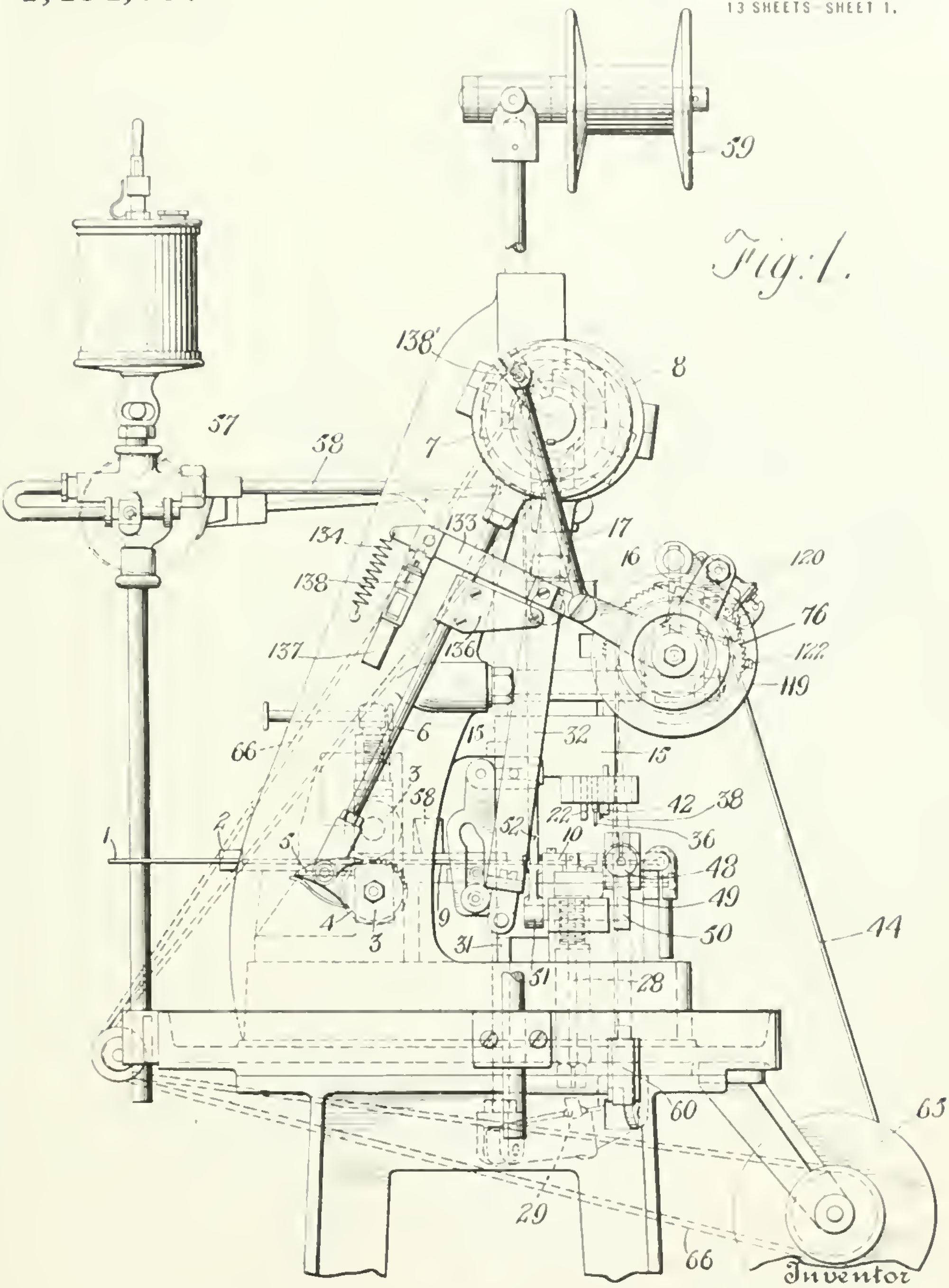

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Fig: 2.

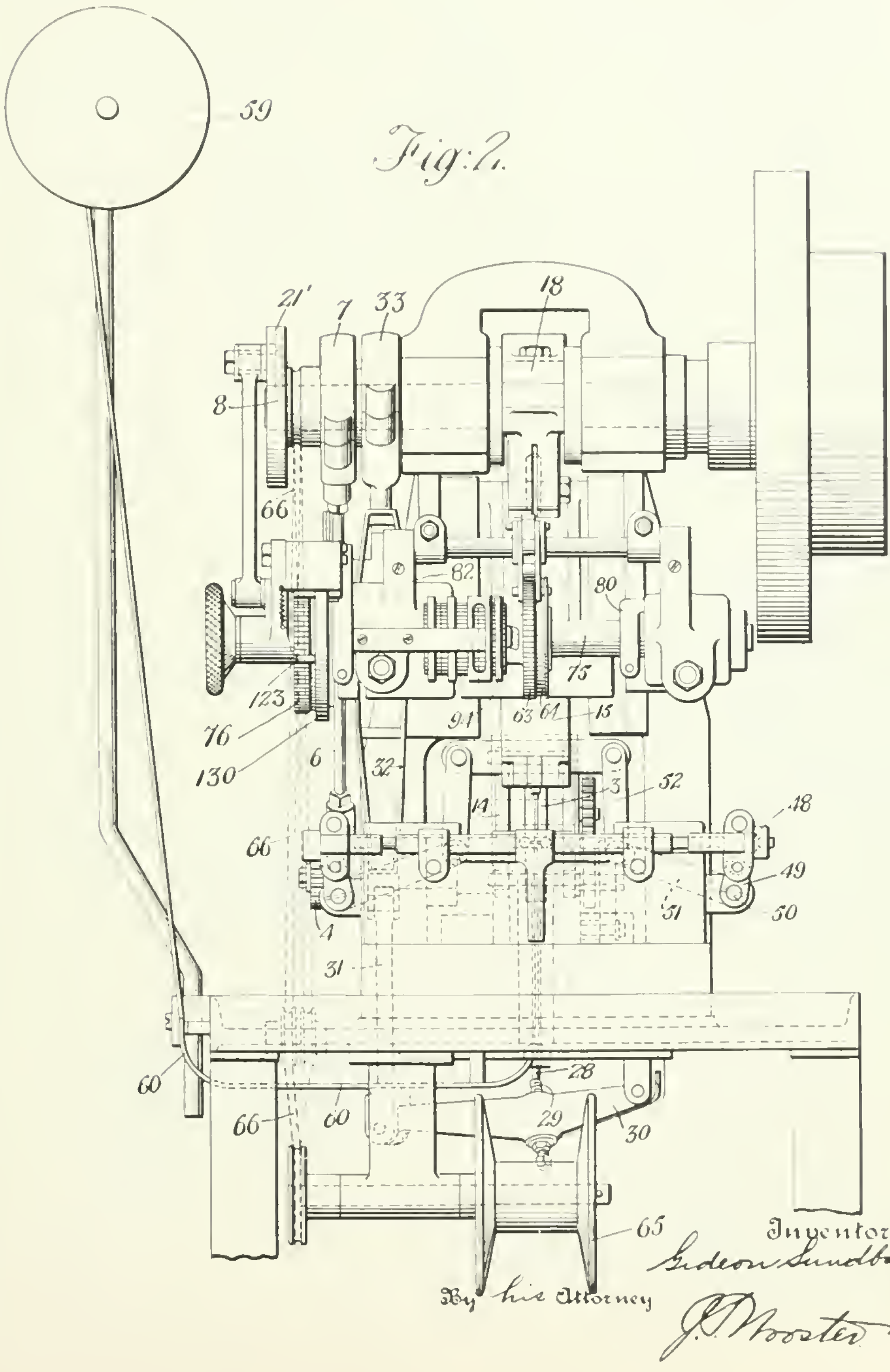

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Fig:5.

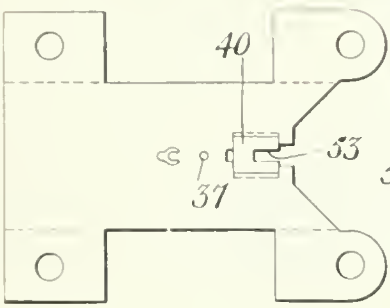

Fig:3.

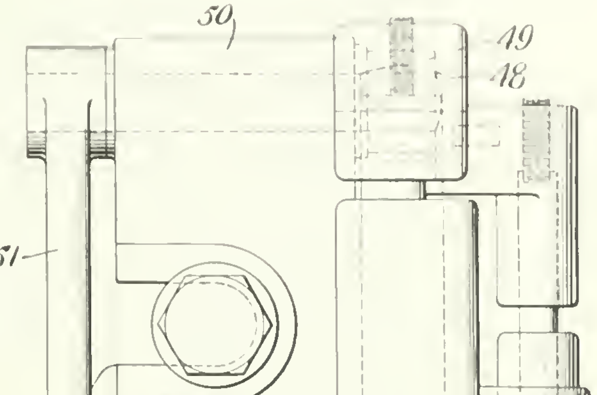
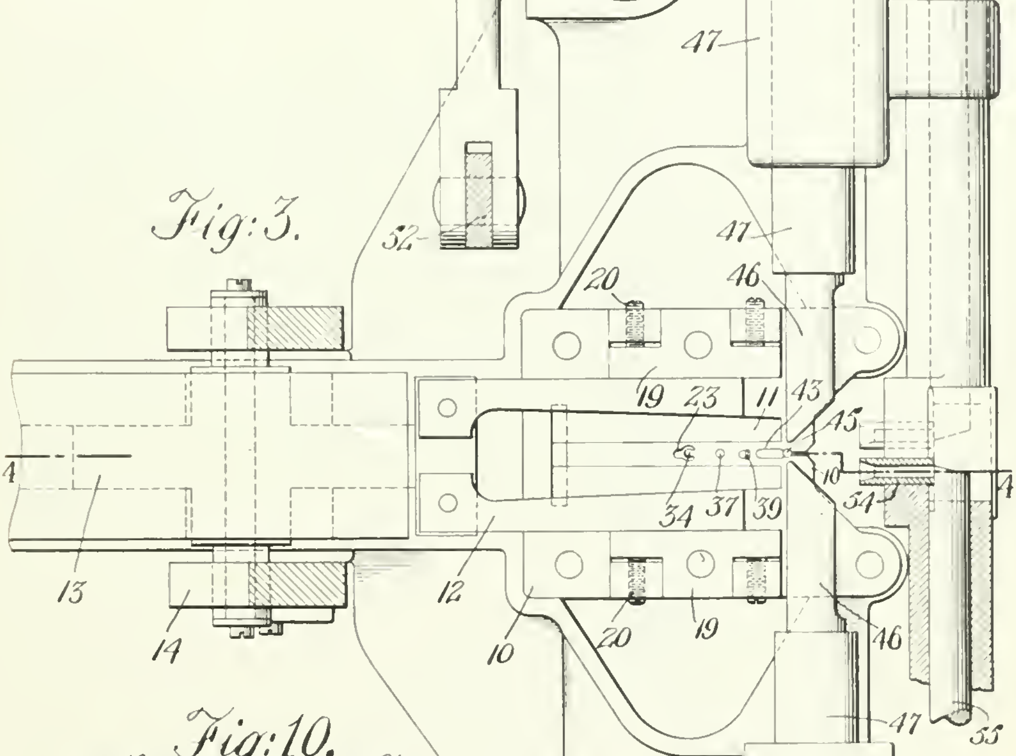

Fig:10.

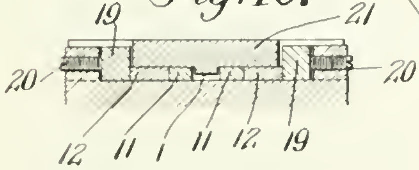

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Fig: 4

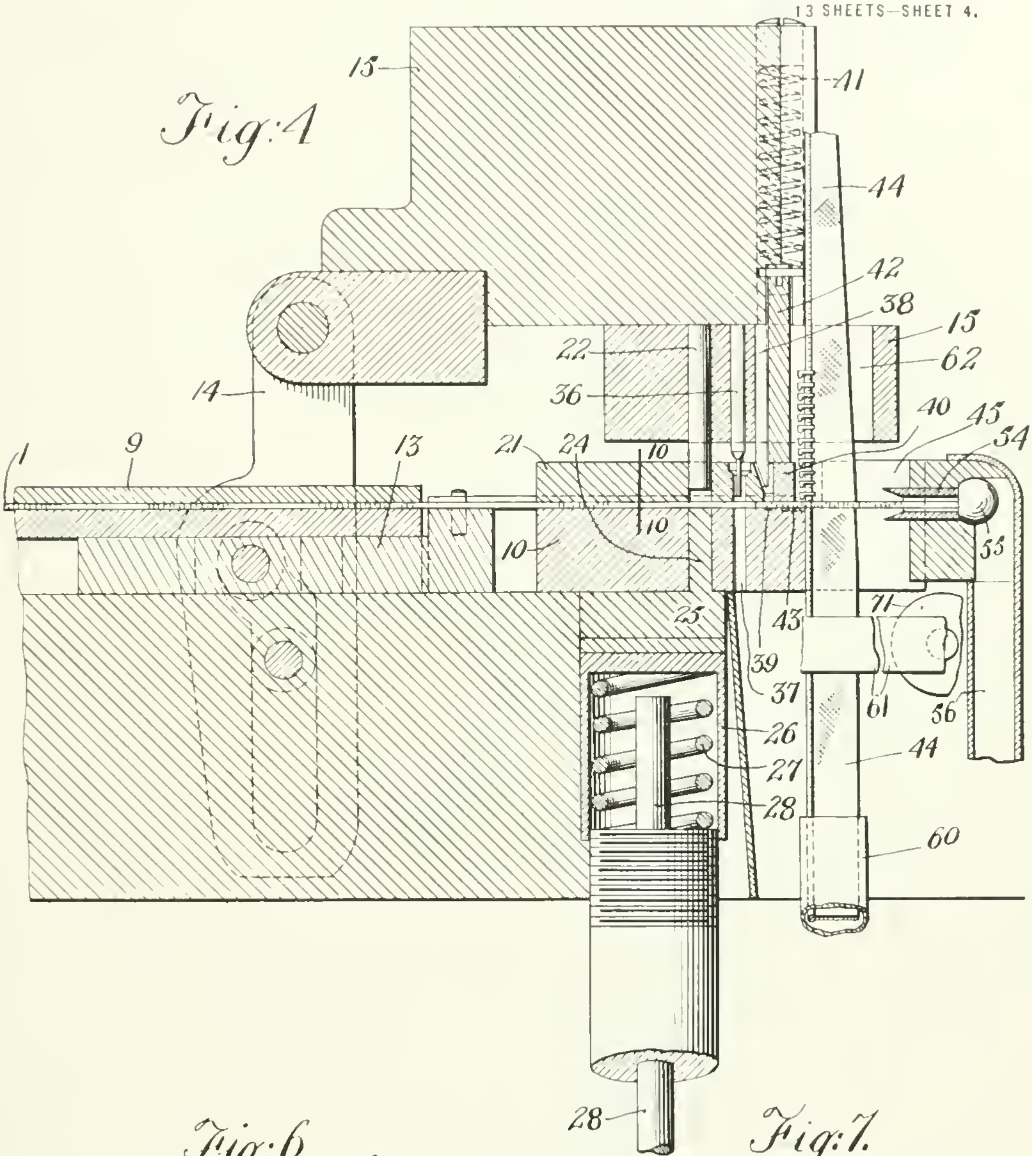
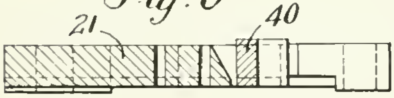


Fig: 6



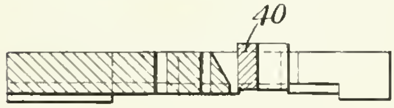
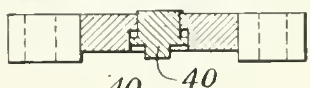


Fig: 8.

Fig: 7.



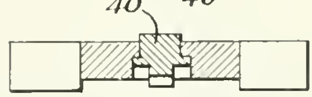


Fig: 9.

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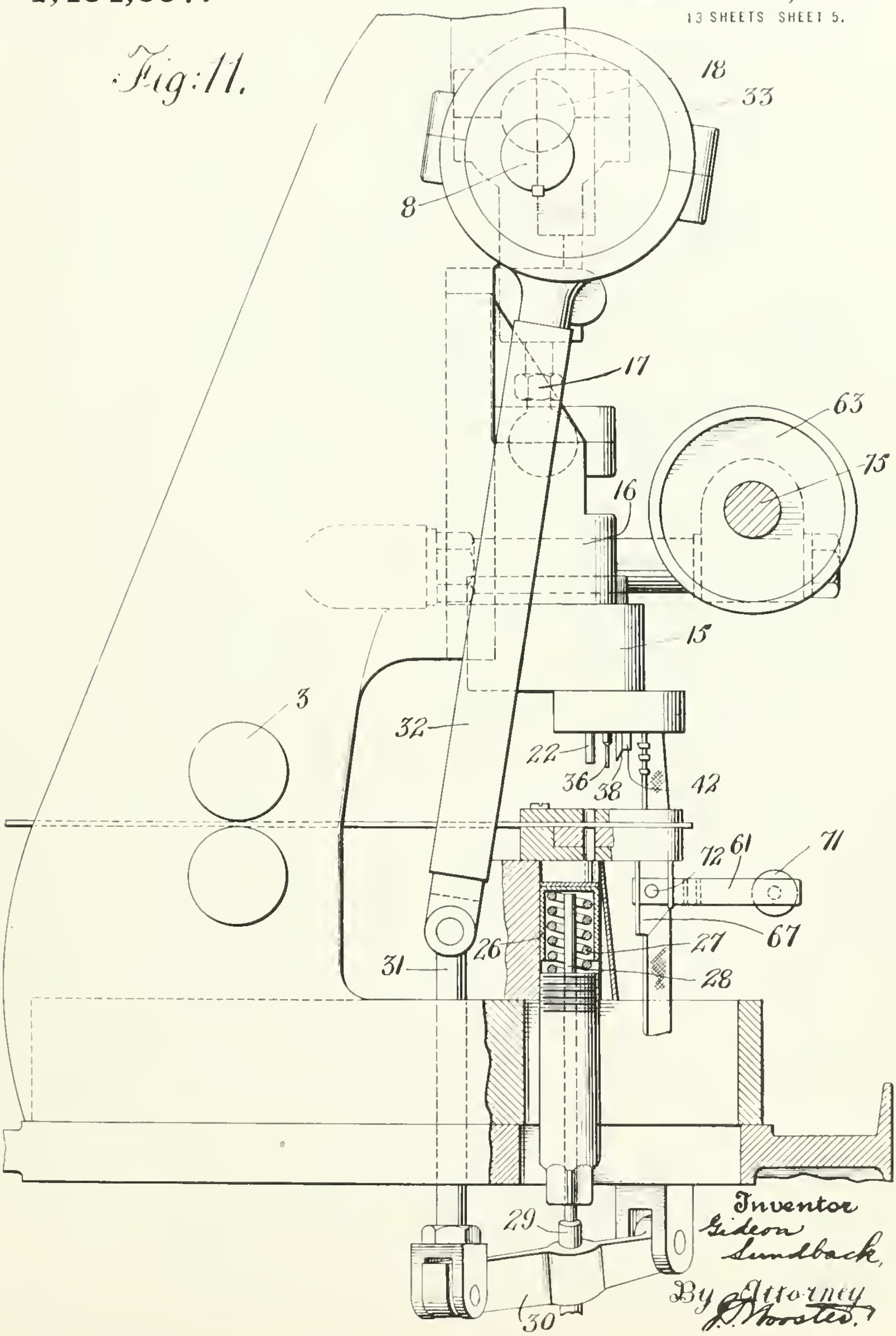
Fig: 11.



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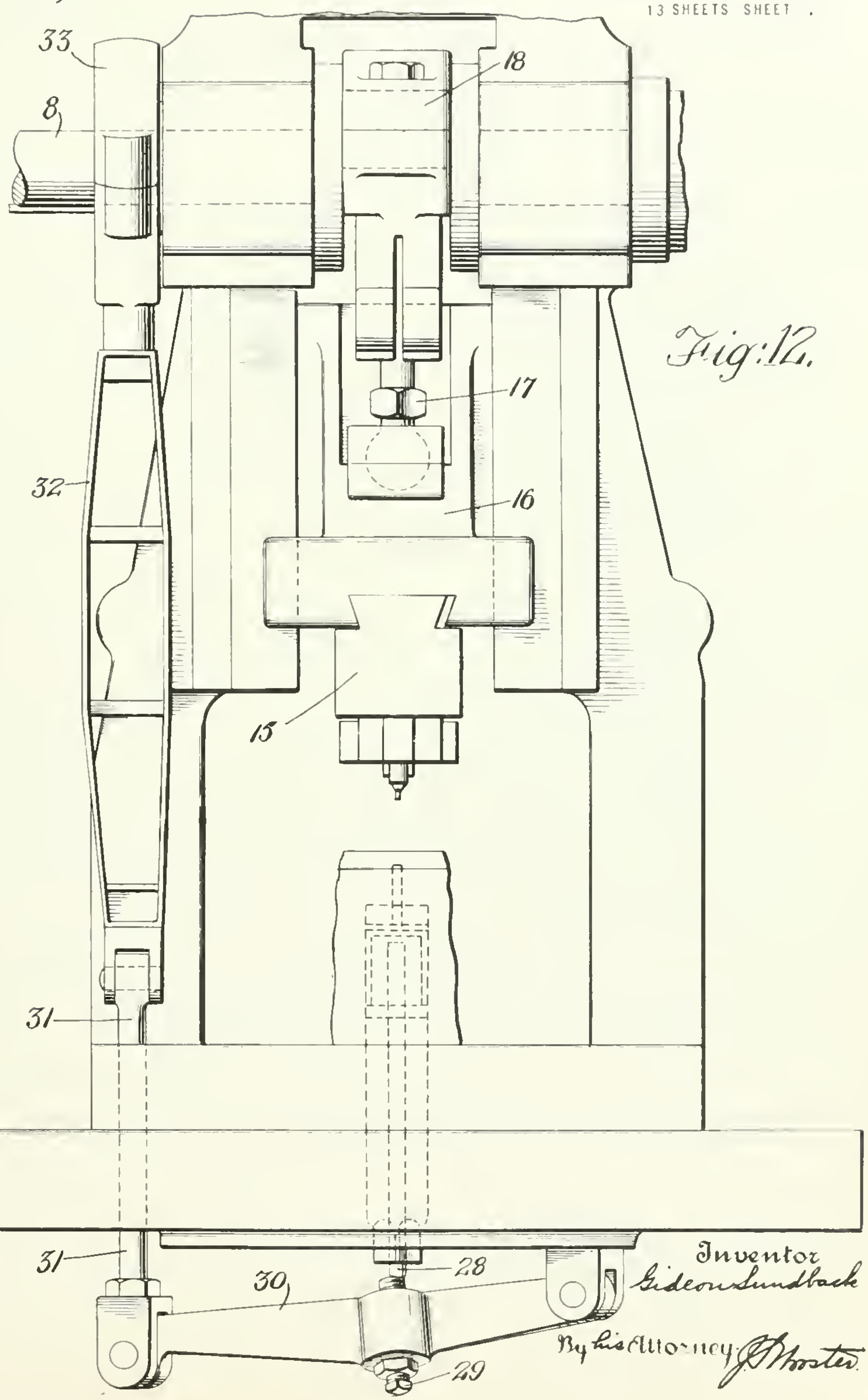

Fig: 12.

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Fig:14.

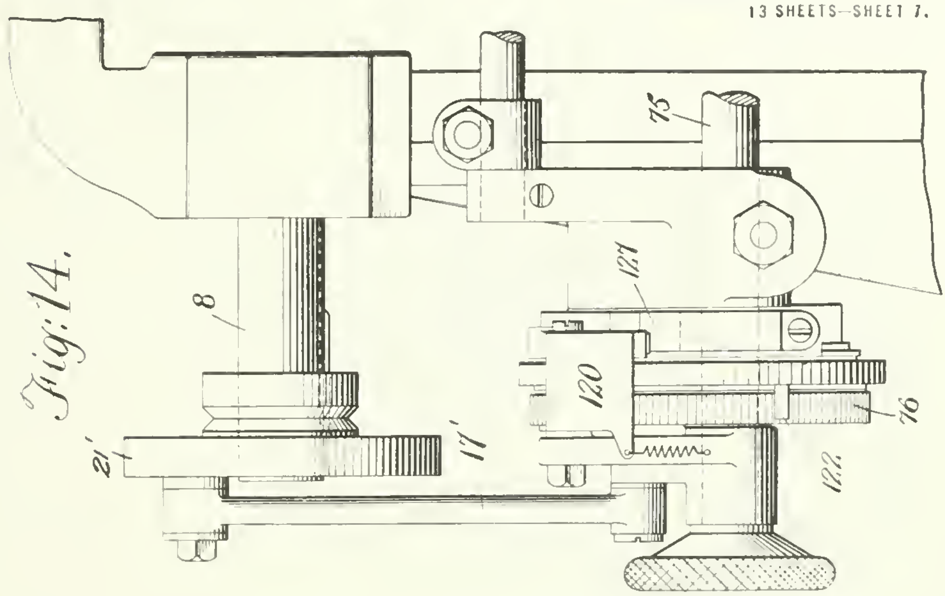
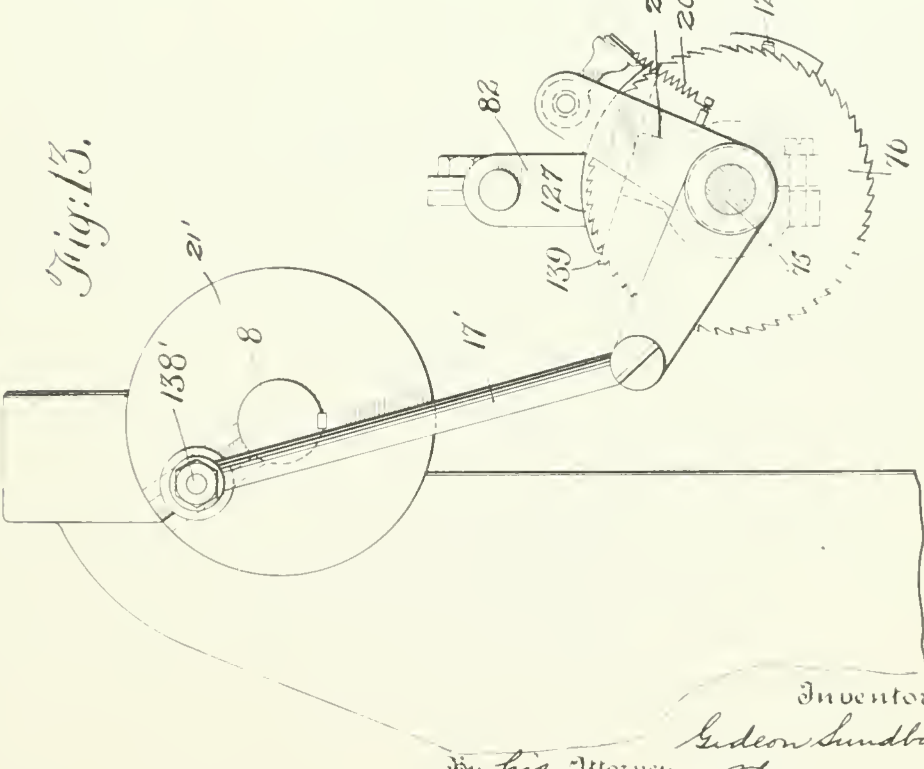


Fig:13.



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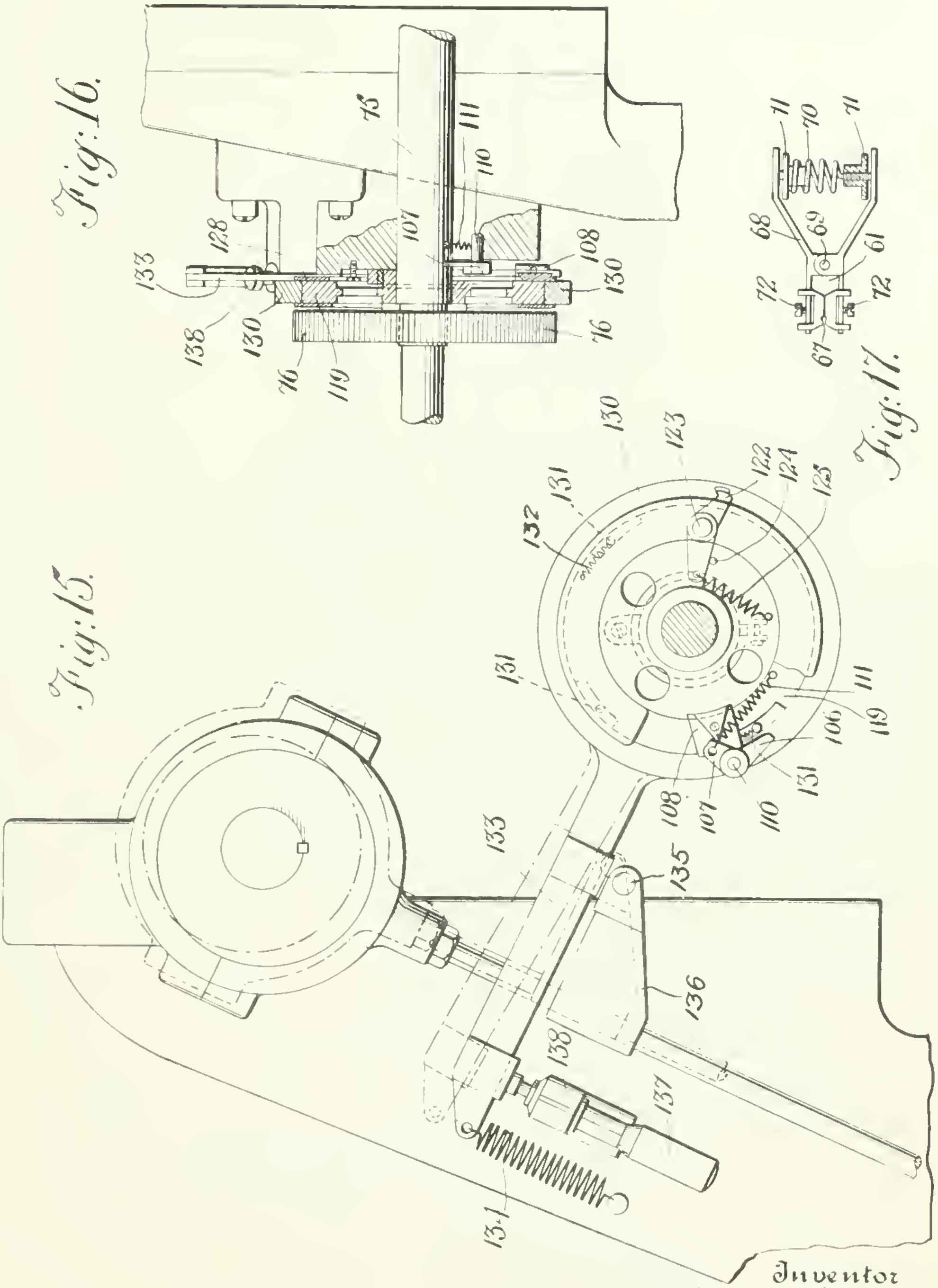

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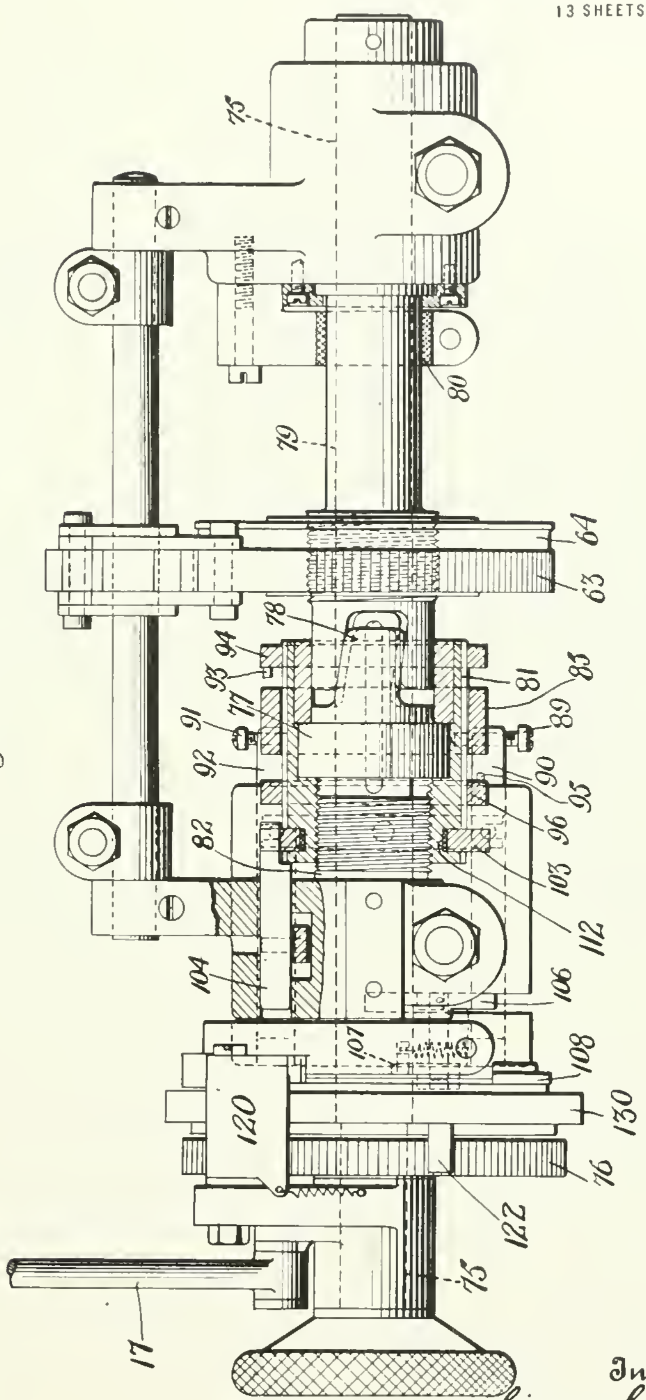

Fig:18.

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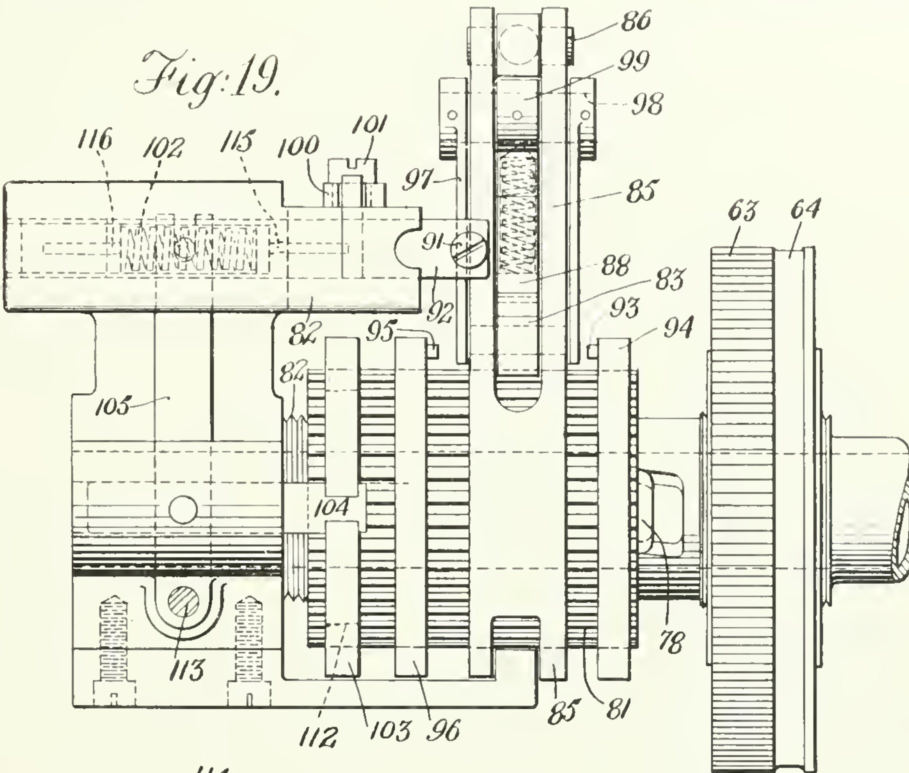
Fig:19.



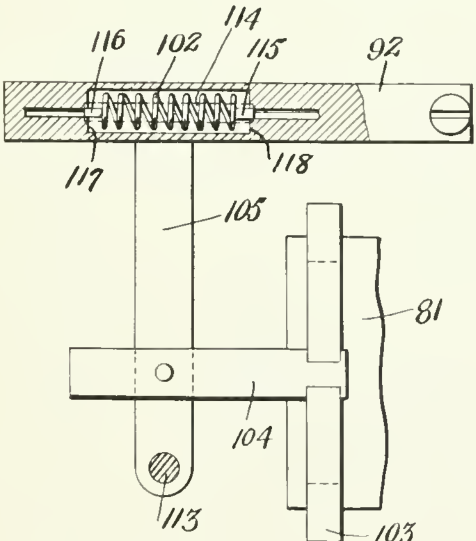


Fig:24.

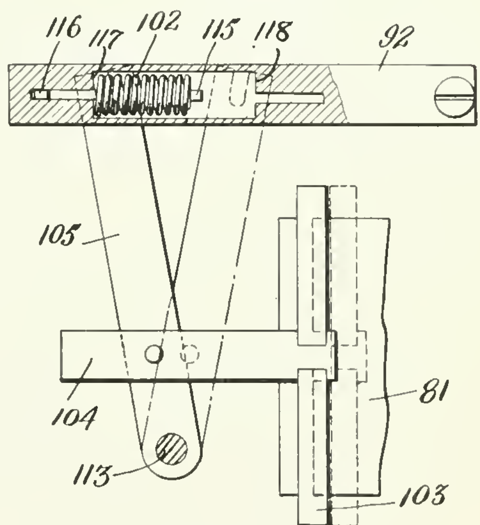


Fig:25.

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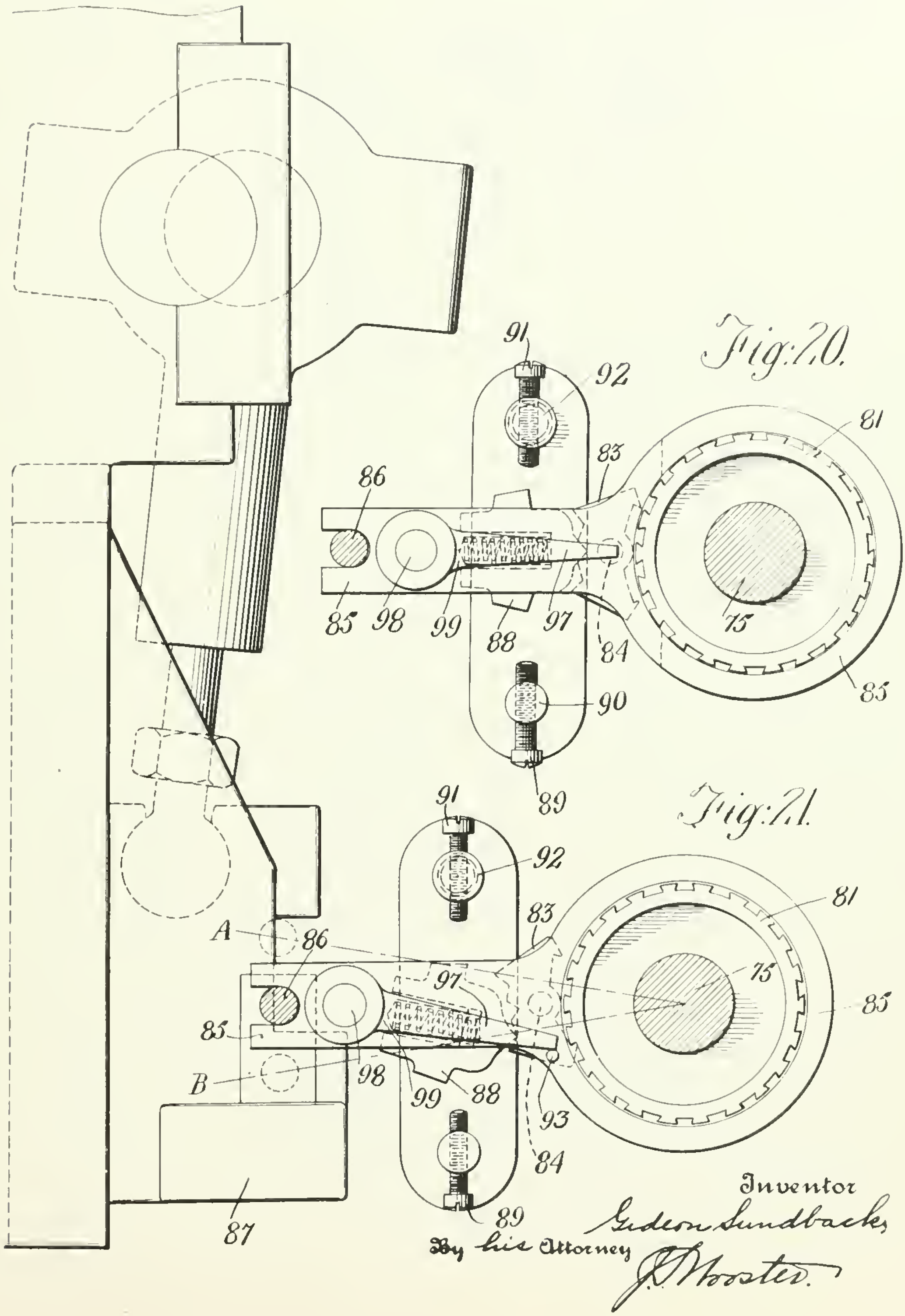

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Fig: 23.

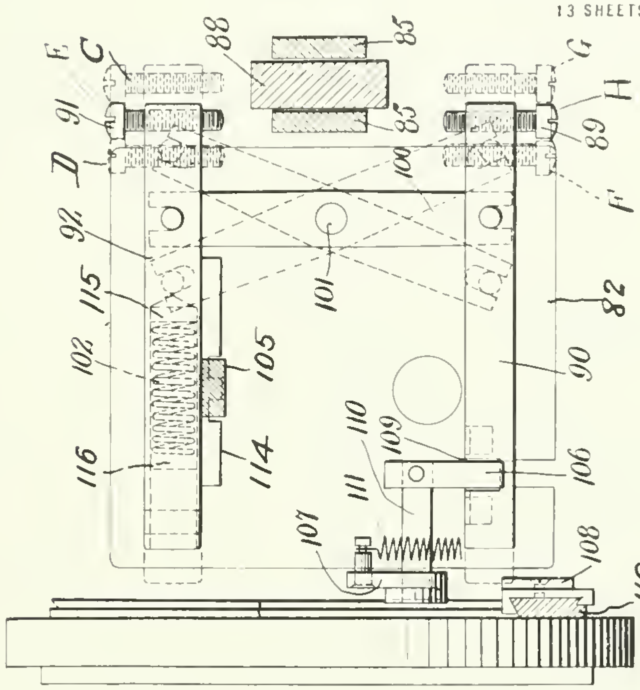
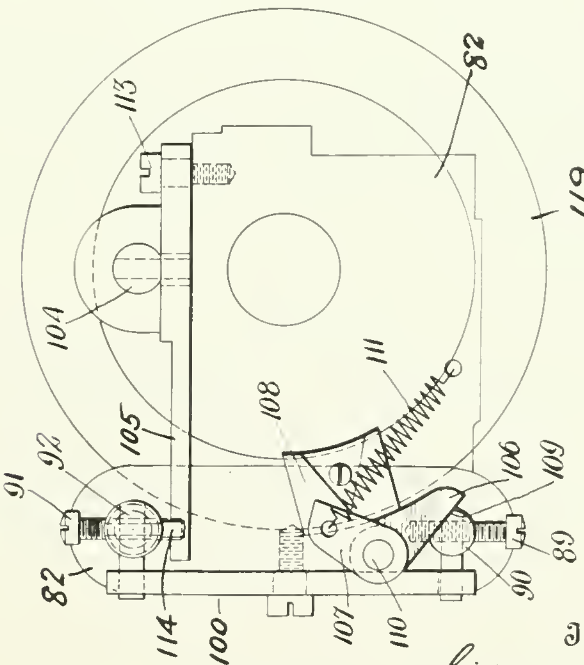


Fig: 22.



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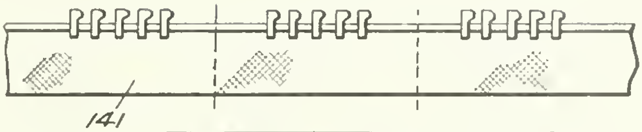


Fig:27.

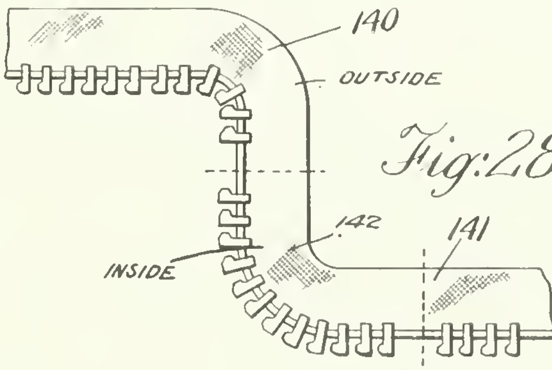


Fig:28.

Fig:26.

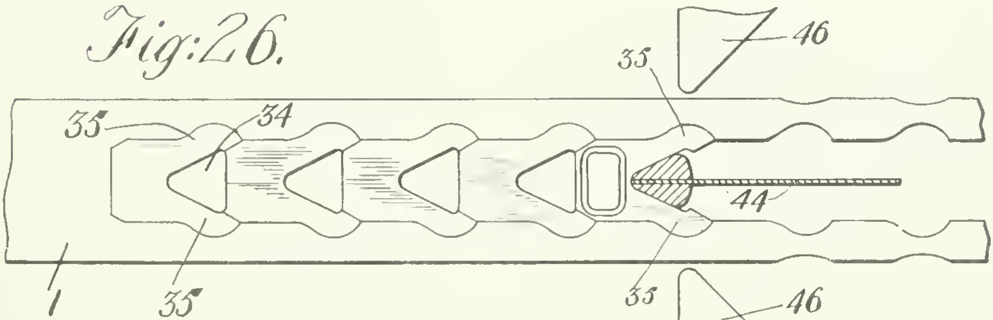
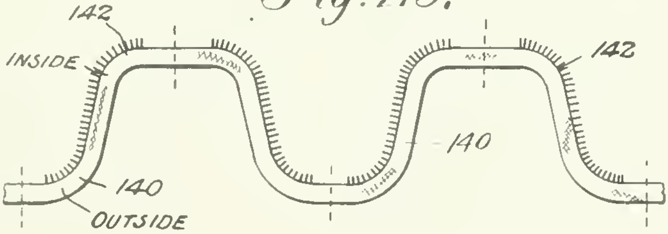


Fig:29.



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Patented Nov. 7, 1922. **1,434,857**

UNITED STATES PATENT OFFICE.

GIDEON SUNDBACK, OF MEADVILLE, PENNSYLVANIA, ASSIGNOR TO HOOKLESS FASTENER COMPANY, A CORPORATION OF PENNSYLVANIA.

MAKING FASTENERS.

Application filed October 19, 1918. Serial No. 258,918.

To all whom it may concern:

Be it known that GIDEON SUNDBACK, a subject of the King of Sweden, and resident of Meadville, in the county of Crawford and State of Pennsylvania, has invented certain new and useful Improvements in Making Fasteners, of which the following is a specification.

This invention relates to a machine and method for producing straight and curved fastener stringers, such as shown in my Patent No. 1,219,881 dated March 20, 1917, and also the curved stringers shown in my application Serial No. 159139, filed April 2, 1917.

By the method herein disclosed, fastener stringers embodying a predetermined number of interlocking jaw members are made on a straight stringer for a predetermined curve, which are cut apart and assembled on the curved closure, one stringer with varying spacing of the interlocking members combining with a succeeding one with different spacing to form a complete accurately fitting fastener.

The uses of this fastener are very diversified, straight fasteners as shown in said patent being used on corsets, money belts, footwear, clothing, stretchers, tents and other closures of various kinds, while curved fasteners as shown in said application are used for automobile curtains, hand hole closures, etc. where by reason of the curve, a wider or more convenient opening is obtained than with an equal length of straight fastener. In order to produce a curved fastener which will be easy to apply and properly function, the spacing of the members on the outer stringer should vary relatively to the spacing on the inner stringer, while on a straight fastener, the spacing is the same.

The general type of machine is disclosed in my Patent 1,331,884, dated February 24, 1920, of which this application is a continuation in part, the novel features of this application being specifically in the tape feeding mechanism, and broadly in the combinations thereof with the jaw member making and setting mechanisms of said earlier application.

In the accompanying drawings,

Fig. 1 is a side elevation of a machine,

Fig. 2 is a front elevation,

Fig. 3 is a plan view showing the die and die block,

Fig. 4 is a vertical section on the line 4—4 of Fig. 3,

Figs. 5, 6, 7, 8 and 9 are details of the top or stripper plate, which hold the blank down on the dies;

Fig. 10 is a cross-section on the line 10—10 of Fig. 4 showing the passageway for the blank;

Figs. 11 and 12 are side and front elevations, respectively, showing the movements by which the punching is pressed back into the blank as the punchers are withdrawn;

Fig. 13 is a side view of the tape feeding mechanism;

Fig. 14 is a front view of the tape feeding mechanism;

Fig. 15 is a side elevation showing a further detail of the tape feed;

Fig. 16 is a further detail front view;

Fig. 17 is a plan view of the tape tension;

Fig. 18 is a front view of the variable tape feeding mechanism;

Fig. 19 is a top view;

Fig. 20 is an end view of a double pawl controlling mechanism in neutral position;

Fig. 21 is an end view in acting position,

Fig. 22 is an end view of the tripping mechanism;

Fig. 23 is a front view of Fig. 21;

Figs. 24 and 25 are top views of details;

Fig. 26 is a plan view on an enlarged scale showing the blank and jaw members at different stages;

Figs. 27, 28 and 29, show various forms of stringers produced by different settings of the machine.

1 represents a metal blank, which may be in the form of a flat strip, which is fed into the machine from the rear toward the front. The machine is applicable to separate blanks as well as to a continuous strip, but in making very small fasteners such as herein shown, which may be as small as one-eighth inch long and one-sixteenth inch wide when fastened and applied to the tape, it is preferable to employ a strip. Referring to Figs. 1 and 4, the blank 1 enters guide 2 and

passes through feed rolls 3, 3, then through guide 9 to the die unit 10, and between the side guide plates 11, (see Figs. 3 and 10). The guide plates 11 are controlled by wedges 12 (see Figs. 3 and 10). The wedges 12 are operated through a slide 13 (see Figs. 3 and 4), and cam plates 14 by the punch head 15, held in the slide 16 (see Figs. 11 and 12) and moved up and down through connecting rod 17 and crank 18 on the main shaft 8. The feed rolls 3, 3 are operated by ratchet 4, pawl 5 and connecting rod 6 from eccentric 7 mounted on the main shaft 8 (see Figs. 1 and 2).

22 is the blanking punch which punches out the entire member and the piece 34 into die 23 (see Figs. 3 and 4). As the punch 22 draws out of the die, the plunger 24 carried by plunger holder 25 and sleeve 26, is actuated by spring 27 to press the punchings back into original place in the metal blank 1. The piece 34 (Fig. 26) lies in the blank between the jaws 35 of the punching. This scrap piece 34 is pushed out of the blank 1 by punch 36 (see Fig. 4) into the hole 37 in die unit 10. The next step is to press or form the punching in its final form ready to be clamped on the tape, and this is effected by punch 38 and recess 39 in die unit 10 (Figs. 4 and 5).

On the down stroke of head 15, as the punches are nearing the blank, the cam plates 14 (see Fig. 3) draw the wedges 12 toward the back, pressing the guide plates 11 toward each other with the blank in between, thus holding the blank firmly in place until released by the forward movement of the wedges 12 on the up stroke of head 15. Figs. 3 and 4 show the position at the moment the clamping movement of the guide plates 11 has been effected. To allow for wear and variation in the width of the blank, 1, the space between the guide plates 11 is adjustable by blocks 19 and set screws 20 (see Figs. 3 and 10).

The function of the guide plates 11 is of vital importance. At the time of punching, the two plates hold the material firmly against spreading and distortion either of the punching or of the blank. This enables the subsequent operations on the punching to be controlled through the blank, and ensures such perfect shape of the finished punchings and correct positioning thereof in the dies, as to produce a highly uniform and symmetrical fastener member and product. When the guide plates 11 draw tight around the blank 1, they not only bring the blank into a central position over the dies, but force the punchings, if they should happen to get out of place, into correct position lengthwise of the blank. The guide plates spread apart during the feed and allow an easy and free movement of the blank. It also allows the interlocking or projecting end of the fastener punching to lift up out of the recess 39 (see Fig. 4) in die unit 10 after the impression of punch 38.

At this time the blank strip 1, after reaching die unit 10, is confined between die unit 10 on the bottom and stripper plate 21 on the top (see Fig. 10.)

In order to avoid reliance solely upon spring 27 to press the punching back into its original place in the blank as punch 22 withdraws, a positive movement is provided. Rod 28 in addition to spring 27 exerts pressure on sleeve 26 thus forcing the punching into its place in the blank. Rod 28 is acted upon through screw 29 in lever 30 (see Figs. 11 and 12) and connecting links 31, 32 from eccentric 33 on main shaft 8. Upon the return of the punching to its proper place in the blank and with the co-operation of the side guides, 11, top of die unit 10 and stripper plate 21, the punching can now be fed forward by the blank feed rolls 3, 3, without any danger of becoming displaced. A displacement at this time would cause much trouble because of the extreme accuracy required in finished fastener members of such small dimensions.

The blank after return of the punching is fed forward as above stated so that the scrap piece 34 can be pushed out of the blank 1 by punch 36, and then the punching is pressed into recess 39 in die unit 10 by punch 38 to form the interlocking recess and projection. At this time, it is necessary to hold the blank and punching down onto the face of the die unit 10 and also to hold it against lateral spreading by contraction of the side guides 11. The stripper plate 21 partly performs this function, but in addition there is provided a yielding presser or floater 40 (see Figs. 5, 6, 8) which is mounted in stripper plate 21 and bears down on the jaws 35 of the punching, and on the blank 1, by means of springs 41 (see Fig. 4) and plunger 42. This plunger 42 is timed and adjusted to commence pressure as soon as the forward movement of the blank stops, and can be adjusted to exert a positive pressure upon the blank and punching by contacting with a lug on punch block 15 when the punches are in their lowest position. Thus the blank and punching are firmly held in position while the transversely elongated recess and projection are formed by the punch 38 and die recess 39.

When the blank 1, still carrying the fastener member, which is now finished and ready to be pressed on the tape, is again fed forward, the floater or presser 40 yields upwardly so as to permit the projection of the fastener member to lift out of the die recess 39 so that it can be carried forward into recess 43 (Figs. 3 and 4) ready to be set. To prevent the fastener member punching from lifting out of the blank 1 altogether, the lift of the yielding presser 40 is limited as shown in Fig. 9. Figs. 6 and 7 show the presser 40 at its lowest position and Figs. 8 and 9 show it at its highest position.

The finished punching is now carried forward by the next motions of the feed rolls 3, 3 until it reaches the position where the jaws 35 straddle the corded edge of the tape 44 (see Fig. 26). The tape 44 is fed intermittently upwards and at right angles to the blank feed through the hole and slot 45 (see Figs. 3 and 4) in die unit 10. In this position, the jaws 35 are clamped around the corded edge of the tape by side tools 46 (see Figs. 3 and 26) which simultaneously press toward each other on the outside of the blank 1, while the formed jaw member is being held between the top of the die unit 10 and the resilient presser 40 (see Figs. 3 and 4). The side tools 46 which set the jaw members on the carrier element, tape or stringer, are held in the slides 47, which are connected at 48 to lever 49, rock shaft 50, arm 51, and link 52 to punch block 15 (see Fig. 2). When the clamping movement is completed, the tape feeds up and lifts the jaw member clamped to its corded edge, out of the residue of the blank, 1, the tape and attached jaw member passing through slot 53 in floater 40 (see Fig. 5). There now remains of the blank 1 only the two edges, which are fed through the tubes 54 (see Figs. 3 and 4) and cut into small pieces by knives 55 connected to the actuating heads 48 of the side tools, the pieces falling down through chute 56.

In order to prevent slipping of the feed, the blank 1 is maintained clean and dry while engaged by the feed rolls 3, 3, and the necessary lubrication of the blank is done after it has passed the feed. This is accomplished by an ordinary oil pump 57 (see Fig. 1) which drips the lubricant down in tube 58 mounted centrally over the blank 1. Soap and water is preferably used as a lubricant, because it does not leave a stain on a fabric tape.

The tape is wound on spool 59, and leads through guide 60, then up through floating tension 61, through hole 45 in die unit 10, then through hole 62 in the punch holder, then around feed roll 63 having a knurled surface for the tape and a groove 64 for the jaw members, then the tape leads to winding spool 65 driven by belt 66 from the main shaft. The groove 64 serves as a leader and prevents lateral displacement of the tape in passing around feed roll 63. The grip is also assisted by the roughened surface in conjunction with tension 61.

The tension 61, shown in Fig. 17, comprises two tension plates 67 having guiding grooves for the cord, and mounted loosely on the ends of levers 68 which are pivotally connected at 69 and normally pressed apart by spring 70 mounted between screw bushings 71, which can be turned so as to vary the spring pressure at plates 67. The pressure of the jaws is transmitted through screw 72 located at about the center of plates 67, so that the plates can rock slightly on the ends of the screws and adjust themselves to irregularities in the tape without varying the friction. In order to prevent puckering the plates 67 at the entering side are tapered so as to smooth out the tape before it reaches the setting point of the jaw members. It will thus be seen that the tape is positively controlled by the feed roll 63, and the varying control of roll 63 for varying the spacing between jaw members on a single fastener stringer, and the blank spacing between successive stringers will now be described.

Another part of the mechanism when put into operation automatically produces an auxiliary movement of the tape roll by which the regular spacing between the interlocking members is alternatingly increased and decreased in any desired portion of a group of members or stringer, thereby producing in one group an increased spacing corresponding with the decrease in spacing between members in a following group. Two of these alternating groups form a fastener which will, by reason of the difference in spacing, take a curve with the larger spacings on the outside and the smaller spacings on the inside. The increase or decrease in the tape feed added to or taken off from the regular feed is uniform so that the spacing between the members within the portion of increase or decrease remains constant. As a consequence the curve of the fastener is circular in form of a radius proportionate with the difference between spacing of the members on the out and inside stringer. The mechanism is adjustable to make any desired length of curve within its limits.

With this feeding mechanism it is optional to make either straight or curved or a combination of straight and curved fasteners in predetermined lengths. The length of a fastener is determined by the number of interlocking members on the tape grouped together between the blank spaces. When the mechanism is set for producing straight fasteners the spacing between the members in a group is constant.

For each two stringers the mechanism for increasing and decreasing the regular spacing makes one reciprocating trip thus making one complete curve to each fastener only. But as the timing of the mechanism in its relation to the blank spacing between the stringers is adjustable the setting can be made to produce the blank space which divides the stringer in center of a curve or any other part of the curve. It follows that if part of the curve for which the mechanism is set forms the end of one stringer and the other part of the same curve forms the beginning of another stringer a fastener which in effect has two curves, one curving in the opposite direction to the other is produced.

Tape feed roll 63 is rotatably mounted on shaft 75 and is driven thereby through a clutch member later to be described. Keyed to shaft 75 is a ratchet wheel 76, and rotatably mounted on shaft 75 is a bell crank 201, the latter carrying pawl 120 pivotally mounted on one arm thereof, and having its other arm pivoted to and oscillated by connecting rod 17′. Pivoted to the other end of connecting rod 17′ is crank pin 138′ in crank plate 21′, the latter being keyed to shaft 8. Crank pin 138′ is carried by a block clamped or otherwise adjustably secured in a radial slot in crank plate 21′, and by varying the radius of crank pin 138′ the throw of pawl 120 may be adjusted as desired. Spring 202, between bell crank 201 and pawl 120 tends to maintain the latter in engagement with the teeth of ratchet 76. The actual throw of pawl 120 is very much greater than is required for the spacing of the fastener members, only a portion of the actual throw being used for this purpose, while the full throw is used to feed blank spaces. To secure the required effective throw for proper spacing, a shield 127 is provided over part of the arc of travel of pawl 120 to hold the latter out of engagement with the teeth of rachet 76. Pawl 120 passes over shield 127 near the end of its throw, and spring 202 then draws it into engagement with the teeth of ratchet 76, giving the latter a motion of intermittent rotation. Shield 127 is angularly adjustable to provide for the feeding of any desired number of teeth. For the feeding of uniformly spaced fasteners for straight lengths, the movement of tape feed roll 63 is identical with that of shaft 75. To increase or diminish the space between the fasteners, and so provide for curved lengths, the motion of shaft 75 is modified by a clutch connection, later to be described, in transmitting such motion to tape feed roll 63.

The spacing control obtained by variable movement of feed roll 63 through pawl and ratchet tripping and differential driving means is shown in Figures 18–25. Referring to Figure 18, ratchet 76 acted upon by pawl 120 is keyed to the shaft 75 which carries splined sleeve 77. This sleeve 77 has a spiral clutch connection 78 with the longitudinally fixed sleeve shaft 79 carrying feed roll 63. 80 is a friction brake. The sleeve 77 revolves within and moves longitudinally with drum 81 threaded on to the longitudinally stationary extension of bearing 82, so that by rotary motion of drum 81 the sleeve 77 is moved axially. For regular spacing the drum 81 is stationary and the intermittent uniform movement of ratchet 76 is imparted through shaft 75, sleeve 77, sleeve shaft 79 onto the tape roll 63. To increase or decrease the regular intermittent rotary motion of roll 63, the drum 81 is revolved intermittently corresponding therewith and moves the sleeve 77 axially in one or the other direction, thereby, through the spiral clutch 78, adding to or substracting from the uniform movement imparted by ratchet 76. The drum 81, Figures 20 and 21, is revolved by double pawl 83 pivoted at 84 on rocker arm 85. The latter is connected by pin 86 to cross head 87 and reciprocates, fixed in its vertical plane, between the positions A and B. The back of pawl 83 has three notches, one central which by reason of a good fit with the pointed end of plunger 88 serves to hold the pawl in neutral position, as illustrated in Figure 20, and one at each end to position the spring pressure of plunger 88 to hold the pawl in one or the other of the actuating positions. If the double pawl 83 is in actuating position on one side the feed roll 63 will be accelerated relatively to ratchet 76 through the spiral clutch 78, and if in the other actuating position the feed roll will be retarded, while if the pawl is in neutral position, as shown in Figure 20, the drum 81 is at a standstill and tape roll 63 is acted upon only by the drive through ratchet 76.

The position of the plunger 88 relative to the three notches on the back of pawl 83 is controlled by screws 89 on plunger rod 90 and screw 91 on plunger rod 92, (see Figs. 20, 21, 22, 23) on one hand and by pin 93 on ring 94 and pin 95 on ring 96, (see Figs. 19, 20 and 21) on the other. The screws 89 and 91 act on the spring plunger 88 to move it out of neutral position into one or the other actuating positions, in other words control the starting of the increased or decreased spacing of the fastener members, whereas the stopping is controlled by the pins 93 and 95. The rings 94 and 96 (see Fig. 19) are adjustably fastened to, as by set screws (not shown), and move with the drum 81 whose length of travel is determined by their positions. Revolved by the pawl 83, the drum carries the pin 93 on ring 94 in a screw thread line until the pin pushing on one branch of the double lever 97 (see Figs. 21 and 19) connected with the spring plunger 88 through shaft 98 and spring barrel 99 throws the spring plunger 88 into the neutral position on back of pawl 83. Figure 21 shows pin 93 about to act on double lever 97. The pin has been brought up into this position by the last upward stroke of rocker arm 85 and is now held by collar 103

(Fig. 19) acting as a brake on the drum 81 to which the ring 94 and pin 93 are fastened. The rocker arm 85 (Fig. 21) is on its downward stroke and plunger 88 will have moved into the neutral notch on back of pawl 83 when it reaches the end of the stroke at position B, thus stopping the movement of the drum 81. The pawl now remains neutral and the drum idle until the spring plunger 88 acted upon by screw 89 on plunger rod 90 (see Fig. 20) throws the pawl 83 into actuating position and starts the drum in the opposite direction to continue until pin 95 on ring 96 (see Fig. 19) arrests the motion by bringing pawl 83 into neutral position through pressure on the other branch of double lever 97. The duration of increased or decreased spacing, in other words the length of a curve in the fastener, is thus controlled by the position of rings 94 and 96 on the drum 81. The collar 103 (see Fig. 18) mounted slidably in a slot of drum 81 has a brake lining 112 which serves to hold the drum against the back stroke of the pawl 83 and pressure on pins 93 and 95 required to throw spring plunger 88 into neutral position as well as to prevent accidental rotary movements.

To start the drum 81 the pawl 83 is thrown from neutral into actuating position by one or the other of screws 89, 91 on plunger rods 90, 92 (see Figs. 23, 24 and 25). The latter slide in bearing 82 and are connected by lever 100 pivoted at 101 on bearing 82. When screw 91 is in central position at E (Fig. 23) the screw 89 is in central position at H. The positions at F and G of screw 89 correspond with positions C and D of screw 91, respectively. Only one of the said screws can be in actuating position at once. To move pawl 83 out of neutral position screw 91 is brought to position C (see Fig. 23) directly above spring plunger 88, so that when rocker arm 85 moves into position A (see Fig. 21) the spring plunger is caused by screw 91 to throw pawl 83 into actuating position as shown in Fig. 21. To revolve drum 81 in the other direction, screw 89 is similarly brought to position G (Fig. 23) to move spring plunger 88 in the other direction as rocker arm 85 moves towards position B shown in Fig. 21. The timing of a period of increased or decreased spacing or in other words the position of a curve relative to the straight portions of a fastener and the blank spaces between the groups of members is thus controlled by the positions of screws 89 and 91 on the plunger rods 90 and 92.

The movement of the plunger rods 90 and 92 carrying the screws 89 and 91 is controlled by the axial movement of drum 81 through collar 103, rod 104, lever 105, pronged slide 114, and spring 102, (Figs. 18–19) on one hand and catch 106, dog 107 and trip 108 on the other, (Figs. 22–23). Catch 106 fits slot 109 in plunger 90 and is solidly connected with dog 107 through shaft 110. Actuated by spring 111 (Fig. 22) the catch 106 is constantly pressing against the plunger rod 90 and when this rod in its travel back and forth brings the slot 109 in line with the catch 106 (Fig. 23) the latter snaps in and locks the plunger rods and screws 91 and 89 in their respective positions E and H. The release of rod 90 is accomplished by the trip 108 (Figs. 22–23) slidably secured to friction ratchet 119. This ratchet makes one revolution for each group of interlocking members or for each stringer. Once in each revolution the trip 108 lifts the catch 106 out of the slot 109 in rod 90 and releases the rods 90 and 92 for longitudinal movements. Referring to Fig. 19 the rod 104, dovetailed to collar 103 in the slot of drum 81, travels back and forth with the axial movement of the drum and through its connection oscillates the forked end of the lever 105 pivoted at 113 as shown in Fig. 25. Guided in a slot in the bearing 82 and interlocked with the forked end of lever 105 is the slide 114, see Figs. 22 and 23, having two prongs 115 and 116 extending upwards into a slot in plunger rod 92, (Fig. 23). The two prongs embrace a compression spring 102 lodged within the plunger 92 (Fig. 24). Moved by the lever 105 the prongs on slide 114 oscillate with the movement of the drum 81 and press the spring 102 against the plunger rod 92 at point 117 when moved in one direction and at point 118 when moved in the other (Fig. 25).

Friction ratchet 119 determines the length of a stringer by timing the increased feed of tape to produce a blank space which separates one group of members from another.

The driving pawl 120 for ratchet 76 automatically feeds ratchet 76 the excess length of tape required for this purpose, through a second pawl 122 (Figs. 15 and 16) pivoted on pin 123 and held against pin 124 by spring 125. Pawl 122 is mounted on the friction ratchet 119, and extends over the teeth of ratchet 76. The friction ratchet 119 is rotatably mounted on shaft 75 (Figures 13 and 14) between ratchet 76 and shield 127, and is held against accidental rotary movement by brake 128 (Fig. 16). As the secondary pawl 122 is carried around on the frictoion ratchet 119, it reaches the position where pawl 120 at the rear end of its stroke rides over it. At the beginning of the forward movement pawl 120 then catches the secondary pawl 122. The spring 125 (Fig. 15) yields to the pressure of pawl 120 allowing the secondary pawl 122 to swing until its forward edge engages the teeth of ratchet 76. The swinging movement being arrested, continued pressure of pawl 120 carries with it the secondary pawl 122, the two ratchets 119 and 76, the shaft 75 and the tape. The ratchet 119 is moved by ring 130 (Fig. 15) through rolls 131 and springs 132. Arm 133 which operates ring 130 is operated by the spring 134 and connecting rod 6 through pin 135 in clamp 136 fastened to connecting rod 6. Eccentric 7 is operated by shaft 8 and carries the connecting rod 6. The stroke of arm 133 is adjustable by the micrometer head 137 in bracket 138 (Fig. 15) attached to the frame of the machine. The adjustment ranges from a maximum length equal to the throw of connecting rod 6 to a very small minimum. Thus the secondary pawl 122, carried around by the friction ratchet 119, is made to complete a single revolution during a predetermined number of operations of the machine according to the setting of micrometer 137, and in this way determines the length of the fastener. When the secondary pawl 122 is effective, it will be seen that a long throw will be given the tape feed, equal to the full stroke of pawl 120.

The trip 108 slidably mounted on the friction ratchet 119 which carries the secondary pawl 122 is adjustable to any position on the ratchet so as to release plunger rods 90 and 92 for action to start the increase or decrease in the spacing at any point of a stringer. This trip 108 starts one curve at a predetermined point in each stringer, but if set in a position relative to the pawl 122, so as to start the curve near the end of one stringer and the curve continues on the next, a fastener made up of stringers as shown in Fig. 29, having one curve at each end will be produced.

When pin 93 on ring 94 stops the barrel 81 (Fig. 19) by moving the spring plunger 88 and pawl 83 (Figs. 20 and 21) into neutral, the rod 104, (Fig. 19) has moved with the drum and brought the lever 105 into a position illustrated in Fig. 25, where the position of prong 115 on slide 114 held by the lever exerts pressure on plunger rod 92 at point 117. The plunger rod 92 by reason of its connection through lever 100 with plunger rod 90 is held by catch 106 in slot 109 (Fig. 23) and screws 89 and 91 locked in their respective positions H and E. The rocker arm 85 is brought to idling up and down between A and B (Fig. 21). The sleeve 77 is held axially by the idle drum 81 and revolving intermittently with the motion of shaft 79 transmits to tape roll 63 the movements of ratchet 76 and feeds the tape for regular spacing of a straight fastener. The friction ratchet 119 is travelling in accordance with the stroke of arm 133 (Fig. 15) and brings the trip 108 (Fig. 22) in a clockwise direction up towards the trip 107. Continuing the movement of the trip 107 catch 106 is lifted out of the slot 109 and forced by the spring pressure at point 117 (Fig. 25) the plunger rods 92 and 90 (Fig. 23) are suddenly thrown into new positions and bring screws 89 and 91 from their neutral positions at H and E into positions G and D respectively (Fig. 23). Screw 89 is now directly in line with spring plunger 88 and forces it out of neutral position shown in Fig. 20, upwards, as the rocker arm moves down from position A into B (Fig. 21) and brings pawl 83 into actuating position. The drum 81 now commences its intermittent rotary movement in an anticlockwise direction and guided by the left threads on bearing extension 82 (Fig. 18) moves axially towards the tape feed roll. Sleeve 77 now transmits to the tape feed roll 63 for each revolution of the machine the regular forward movement of pawl 76 as well as a regular slight backward movement as the clutch end of sleeve 77 moves longitudinally into the clutch end of sleeve shaft 79 (Fig. 18) producing as a result a shortened forward movement of the tape feed roll 63 or a decreased spacing between the members going onto the tape. As the drum 81 continues its axial movement the lever 105 releases the spring pressure at point 117, (Fig. 25) and gradually exerts pressure in the opposite direction through prong 116 at point 118. Free to move, the rods 90 and 92 yield to the spring pressure and move the screws 89 and 91 back from the positions G and D towards H and E, (Fig. 23). When reached, the catch 106 which has meanwhile been passed by the trip 108 and now controlled by spring 111 snaps into the slot 109 and locks the screws 89 and 91 in the H and E positions. The lever 105 continues to move with the drum and prong 116 (Fig. 25) is now compressing spring 102 against point 118 in rod 92 which is now locked. The movement of the drum 81 continues until pin 95 on ring 96 comes in contact with the double lever 97, and brings pawl 88 into neutral, stopping the drum and the backward movement imparted to feed roll 63 by the axial movement of sleeve 77, thus reverting the tape feed roll 63 to the regular forward movement of ratchet 76 and spacing of the members for a straight fastener. The trip 108 has meanwhile completed a round with the friction ratchet 119 and again lifts the catch 106. The pressure of spring 102 now directed at point 118 (Fig. 25) snaps the screw 91 on rod 92 (Fig. 23) into actuating position at C and starts the drum in the opposite direction. Sleeve 77 is now moving away from tape feed roll 63 and thereby transmits a slight forward movement to the tape roll, in addition to the regular movement by the ratchet 76, and the machine is thus producing a stringer with increased spacing between the members until the drum is again stopped by pin 93. The secondary pawl 122, which in connection with pawl 120 and ratchet 76, acts upon the tape feed roll 63 to effect the blank space of tape dividing one stringer from another, travels with the friction ratchet 119 at the same rate of speed as the trip 108. The latter is adjustable on the friction ratchet to any position in relation to pawl 123, and when set, repeatedly sets the drum 81 into motion at the predetermined time relative to the action of pawl 123, in other words, places the curve in any desired position in relation to the ends of the fastener. Fig. 29 illustrates a stringer where the action of pawl 122 on the tape roll has taken place while drum 81 was in motion and half ways between the rings 94 and 96, and in this way places, half of one curve at the beginning and half of the other curve at the end of the same fastener.

In order to produce curved fasteners without any straight portions the travel of the friction ratchet 119 is timed by micrometer head 137 (Fig. 15) to correspond with the length of travel of the drum as regulated by the positions of rings 94 and 96, so that trip 108 on the friction ratchet starts the drum off on a reciprocating trip immediately it is brought to rest by either one of the rings. If the pawl 122 acts and produces the blank space simultaneously with this stopping and starting of the drum, that is, groups the members of increased spacing on one stringer and members of decreased spacing on the next, a circular fastener results, whereas if the blank space groups members of increased spacing followed by members of decreased spacing in succession on the same stringer an S shaped fastener will be the outcome.

The radius of the curve is fixed either by the teeth on drum 81, or by the pitch of the threads on bearing 82 and drum 81, or by the pitch of the spiral cam clutch 78. The length of the curve varies with the travel of drum 81 as regulated by the distance between rings 94, 96. The drum should be stopped before trip 108 has made a complete revolution. The acceleration and retard can be timed to occur at any point of the stringer, thereby permitting S shaped stringers such as shown in Fig. 29 to be made.

For making straight fasteners with uniform spacing, the trip 108 is removed from friction ratchet 119, so that the double pawl 83 remains in neutral position after having been once brought there by pins 93 or 95 on rings 94 or 96. The variable spacing mechanism is thus rendered entirely inoperative as long as desired.

Figure 27 shows the strip for straight closure wherein the spacing is uniform while Figure 28 shows the strip for curved closure wherein, the spacing is varied, the spacing of the curved portion 140 of one group forming the outside or convex portion of a curve is the greatest and the spacing of the curved portion 142 of the group forming the inside or concave portion of a curve is the least, varying from the normal or standard interlocking spacing of the straight portion 141 to permit a free and proper action of the fasteners when applied to curved closures. The terms "convex" and "concave" are used with reference to the respective positions occupied by the tape in relation to the mean line of the closure, i. e. the curve defined by the engaging portions of the fasteners. In assembling, the strip is cut as indicated by the dotted lines in Figs. 28 and 29, and a convex portion is fitted to a concave portion, either of which portions being first inverted.

If not much variation in the lengths of fasteners is required, the friction ratchet with secondary pawl 122 can be dispensed with. In this case the ratchet 76 is provided with a high tooth 139 (see Figure 13) which will project up above the surface of shield 127 so as to be caught by pawl 120 during each revolution of ratchet 121. By changing the throw of pawl 120 by adjusting clamp 138′, the length of the metal part of the fastener can be varied to a limited extent without changing the over-all length including the tape ends. To materially change the length of the fastener the number of teeth in the ratchet 76 can be varied, and also the diameter of feed roll 63.

The normal spacing may be varied independently of clutch cam 78 and the variable feed mechanism, either by varying the throw of pawl 122 through the adjustment of crank pin 138′ in the slot in crank plate 21′, or by angularly adjusting shield 127 to render available a greater or less portion of the total throw of pawl 122. Thus the normal straight spacing may be made either greater or less, and as the effect of the variable feed mechanism is superposed upon that due to pawl 122, the resultant rotation may be made greater or less, permitting the fasteners to be spaced for a curve of any desired radius.

The broad principles of the invention can be carried out otherwise than as herein specifically shown, and the invention is not to be limited except as required by the scope of the appended claims.

What is claimed, is:

1. The method of making fasteners adapted to a curved closure consisting in affixing jaw members in spaced groups on a continuous stringer in predetermined number while increasing the spacing of the members of one group and decreasing the spacing of the members of a succeeding group, and cutting such continuous stringer so that said

groups may respectively conform to the respective sides of the closure and interlock with each other in a line following the mean curve of the closure.

2. The combination with means for affixing groups of jaw members to a strip, of means for varying the spacing between members at a predetermined part of a group.

3. The combination with means for affixing complementary groups of fastener members to a strip with predetermined spacing, of means for varying the spacing at the intermediate portion of the group.

4. The combination with means for affixing complementary groups of members to a strip with predetermined spacing, of means for increasing the spacing at one portion of one group and decreasing the spacing at a corresponding portion of another group.

5. The combination with means for feeding a strip and means for affixing jaw members on the edge thereof, of means for varying the spacing of the members on predetermined portions of the strip to produce portions of complementary spacing adapted to form inner and outer members of a curved fastener.

6. The combination with means for feeding a strip and means for affixing jaw members on the edge thereof, of means comprising a feed driven with a predetermined variation of movement relatively to a standard to vary the spacing of the members at a portion of the strip.

7. The combination with means for feeding a strip and means for affixing members spaced for curvilinear interlocking on the edge of said strip, of a strip feed having actuating means for effecting normal interlocking spacing of said members, means for effecting an increased strip feed after affixing a predetermined number of members, and means for varying the normal spacing of members on a predetermined portion of said strip for a predetermined curve.

8. In a fastener making machine, the combination with a feed roll, of means for intermittently rotating said roll, means supplemental to first said means for adding to or subtracting from each impulse thereof a supplemental rotation, and automatic means for starting and stopping the operation of said supplemental means at predetermined times in relation to first said means.

9. The combination with an intermittently driven feed roll, of a differential driving connection between said feed roll and its driving means, and means for controlling said differential driving connection to effect a constant, increased or decreased feed.

10. The combination with a roll for intermittently feeding a strip, of an actuating ratchet, a differential driving connection between said ratchet and said feed roll, and means for controlling said differential driving connection to effect a constant, increased or decreased feed.

11. In a fastener making machine, the combination with a feed roll, of intermittently rotating actuating means, a coupling between said actuating means and said roll, a cam in said coupling for adding to or subtracting from each impulse of said actuating means a supplemental rotation, actuating means for said cam, and automatic means for starting and stopping the operation of said cam actuating means at predetermined times in relation to said intermittently rotating actuating means.

12. The combination with means for intermittently feeding a strip, of actuating means comprising a ratchet and a differential driving connection, a pawl for rotating the ratchet, means for periodically giving the ratchet an increased throw, and means controlling said differential driving connection to permit increased or decreased movement of said feeding means relatively to the normal movement of said ratchet.

13. The combination with means for intermittently feeding a strip, of actuating means comprising a ratchet and a differential driving connection, means for adjusting the normal throw of the ratchet, a pawl for rotating the ratchet, means for periodically giving the ratchet an increased throw, and means controlling said differential driving connection to permit increased or decreased movement of said feeding means relatively to the normal movement of said ratchet.

14. The combination with an intermittently driven feed roll, of a spiral cam driving connection, and means for controlling said cam connection to advance or retard the roll relatively to its normal feed.

15. The combination with an intermittently driven feed roll, of a spiral cam driving connection, and means for automatically controlling said cam connection to advance or retard the roll relatively to its normal feed.

16. The combination with an intermittently driven feed roll, of a spiral cam driving connection, and means, comprising a traveling drum, for controlling said cam connection to advance or retard the roll relatively to its normal feed.

17. The combination with an intermittently driven feed roll, of means for actuating said roll to give a normal feed, a lost motion connection comprising a spiral cam between said actuating means and the roll, and means for variably controlling the lost motion.

18. The combination with an intermittently driven feed roll, of means for actuating said roll to give a normal feed, a lost motion connection comprising a spiral cam between said actuating means and the roll,

and means, comprising a double pawl, for variably controlling the lost motion.

19. The combination with means for feeding a strip and means for affixing groups of interlocking fastening members thereto, of a strip feed having actuating means for effecting normal interlocking spacing of said members, and means for varying the normal interlocking spacing of said members on a predetermined portion of the strip to permit of interlocking on a predetermined curve.

20. In a fastener making machine, the combination with a feed roll, of means for intermittently rotating said roll, means supplemental to first said means for adding to or subtracting from each impulse thereof a supplemental rotation, control means for said supplemental means, and means for varying the amount of the resultant rotation.

21. In a fastener making machine, the combination with a feed roll, of intermittently rotating actuating means, a coupling between said actuating means and said roll, a cam in said coupling for adding to or subtracting from each impulse of said actuating means a supplemental rotation, actuating means for said cam, control means for said cam actuating means, and means for varying the amount of the resultant rotation.

Signed at Meadville, in the county of Crawford and State of Pennsylvania, this 12th day of October A. D. 1918.

GIDEON SUNDBACK.

Witnesses:
C. I. Clancey,
I. W. Lang.

DEFENDANT'S EXHIBIT "BG"

G. Wintriss Patent No. 2,336,662

Filed June 5, 1941 Patented Dec. 14, 1943

Dec. 14, 1943. G. WINTRISS 2,336,662

APPARATUS FOR MAKING SLIDE FASTENERS

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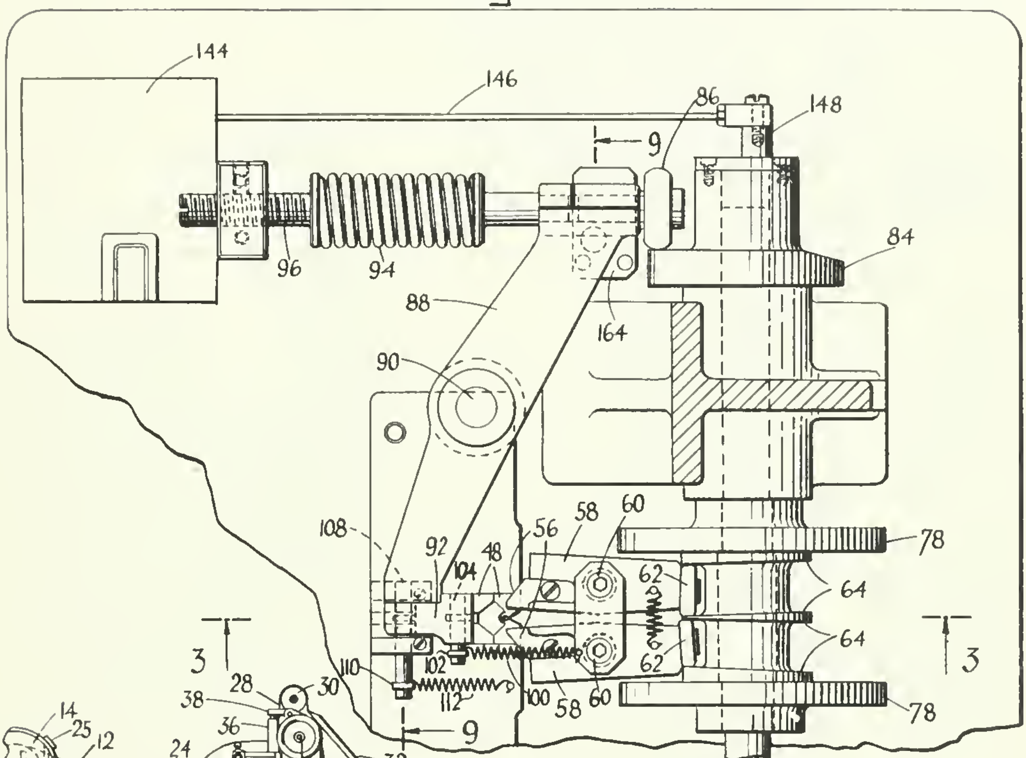
Fig. 2



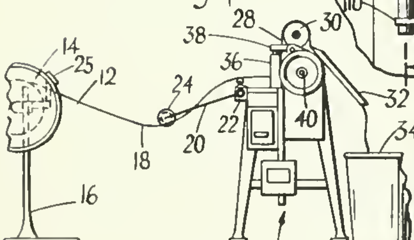


Fig. 1

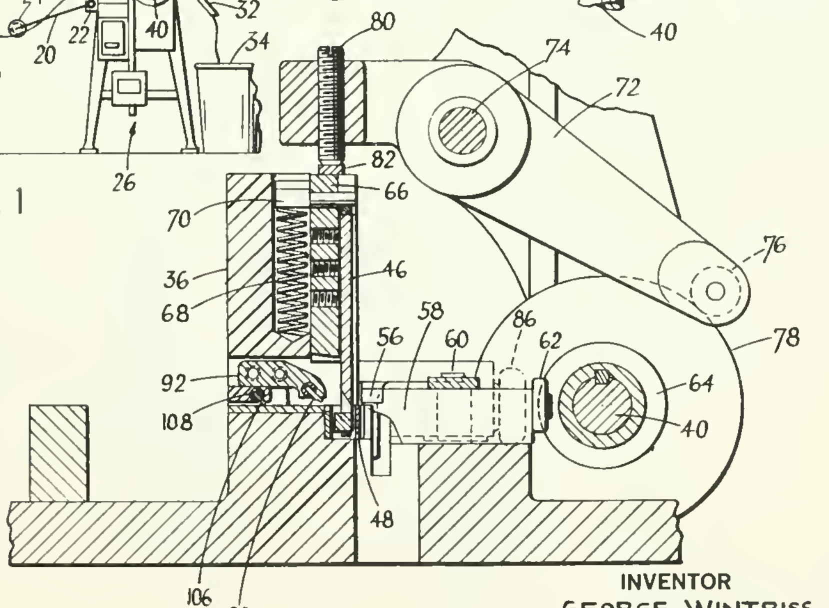


Fig. 3

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Fig. 5

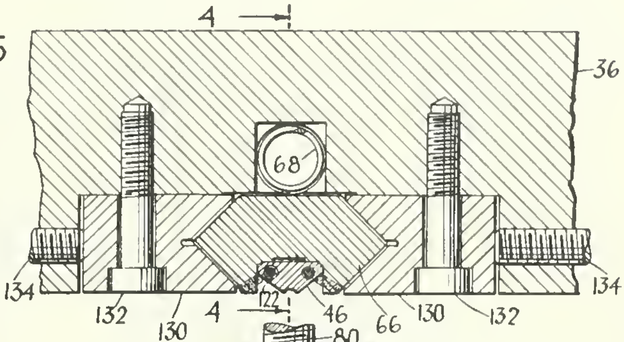
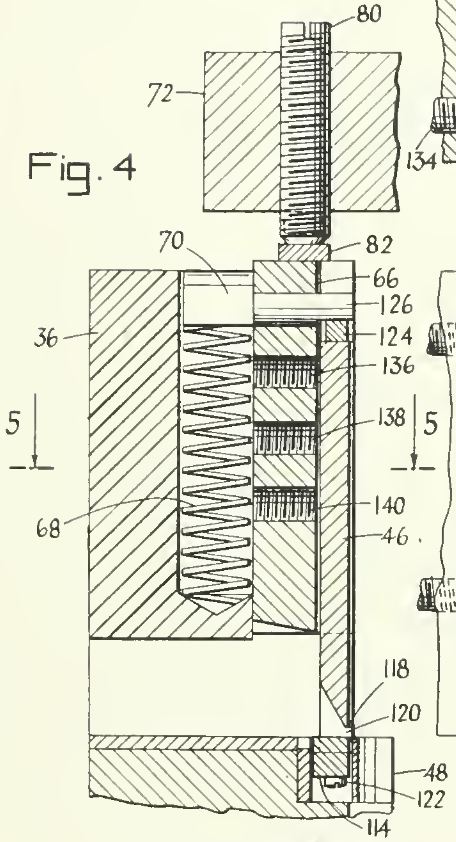


Fig. 4



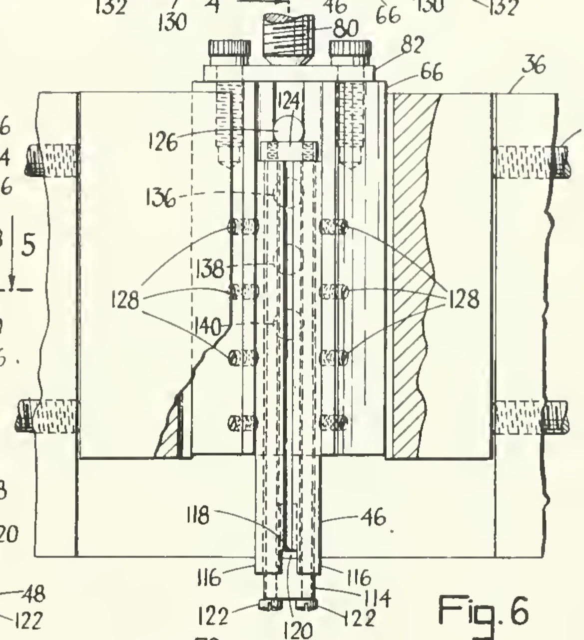


Fig. 6

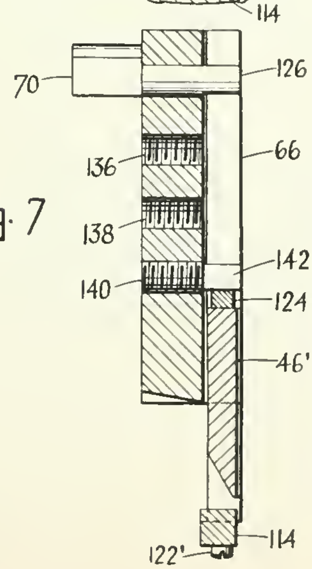


Fig. 7

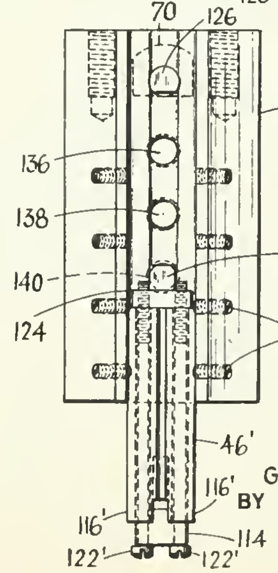


Fig. 8

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Fig. 9 Fig. 10

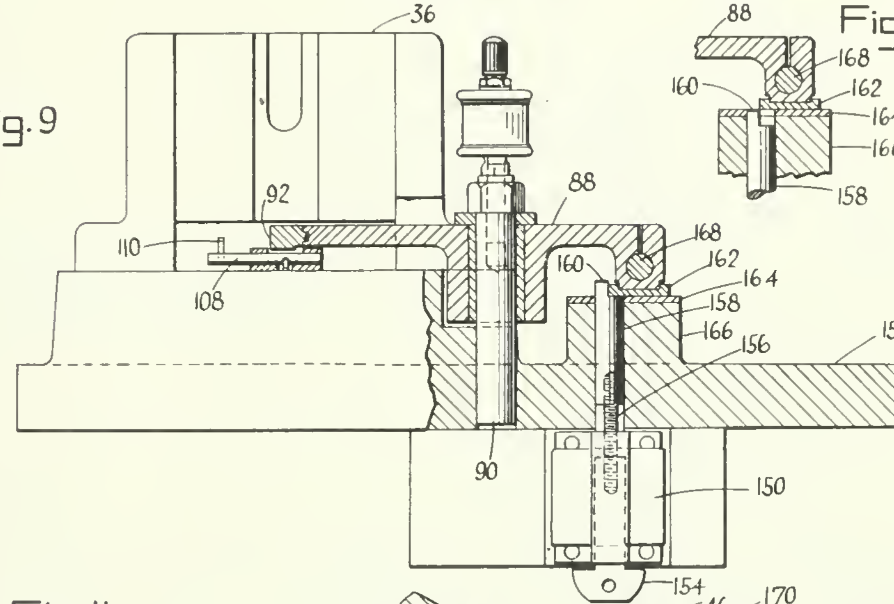

Fig. 11

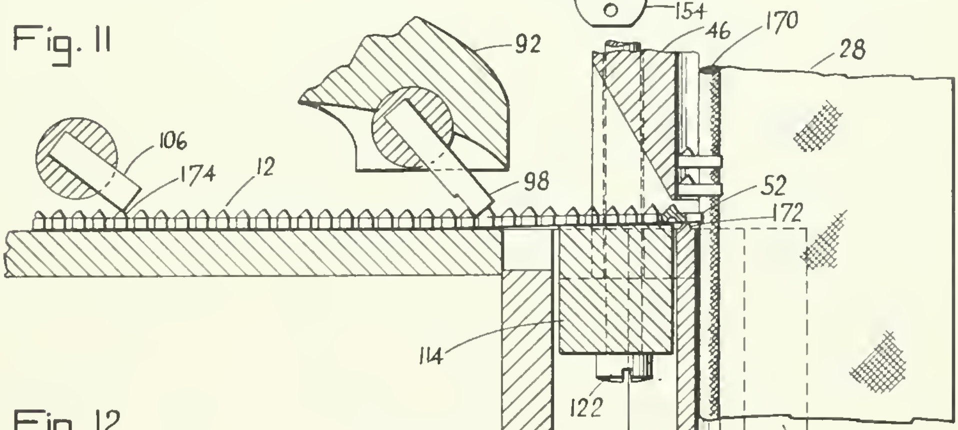

Fig. 12

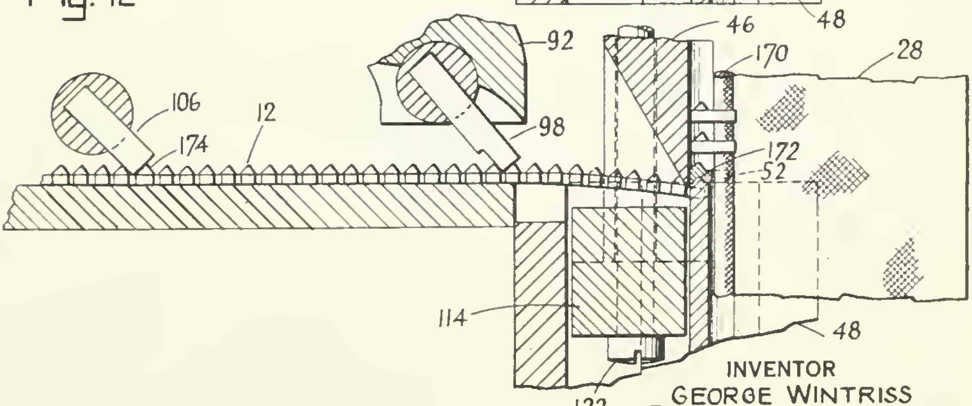

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Fig. 13

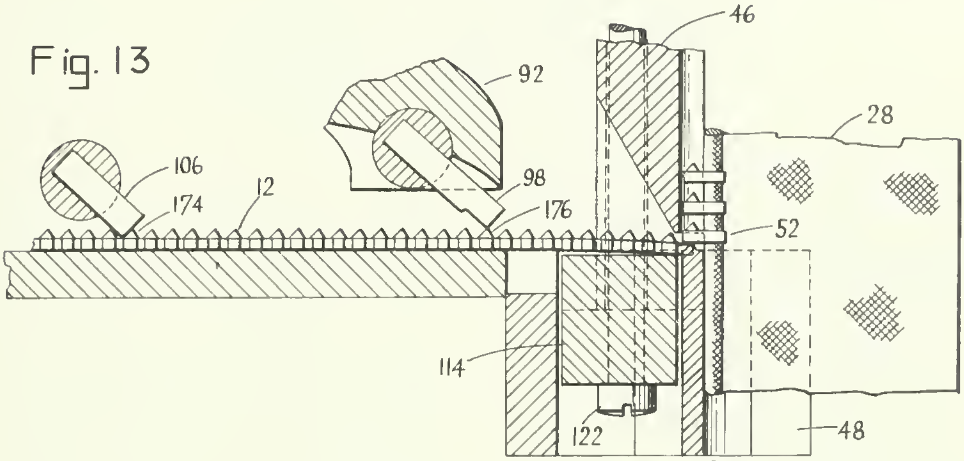


Fig. 14

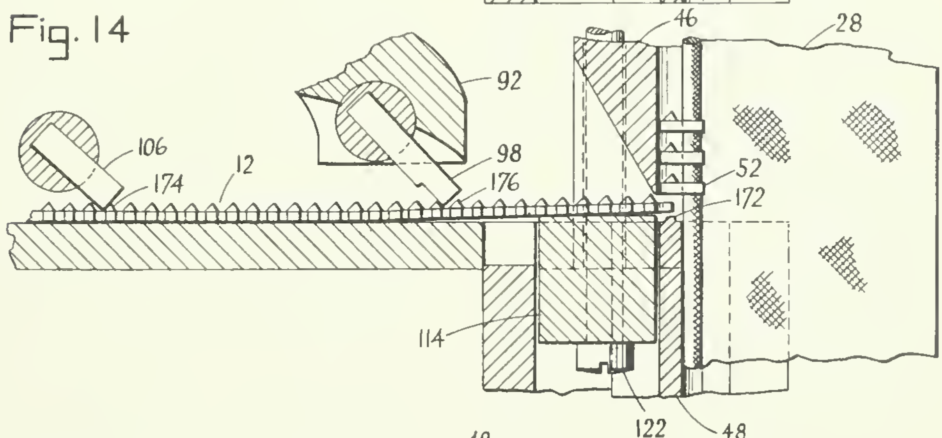
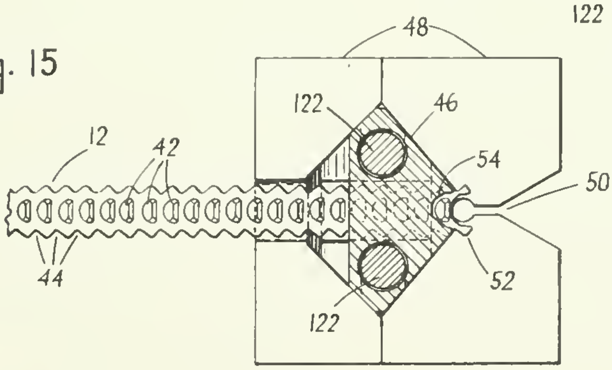


Fig. 15



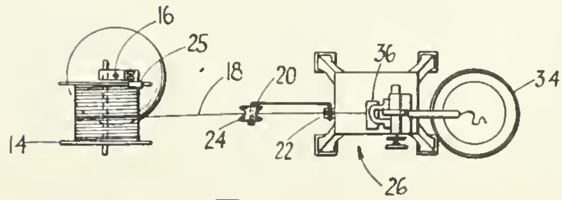


Fig. 16

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UNITED STATES PATENT OFFICE

2,336,662

APPARATUS FOR MAKING SLIDE FASTENERS

George Wintriss, Alexandria, Va., assignor to Conmar Products Corporation, Bayonne, N. J., a corporation of New Jersey

Application June 5, 1941, Serial No. 396,661

14 Claims. (Cl. 164—88)

This invention relates to apparatus for making slide fasteners.

The primary object of the invention is to simplify the construction and to increase the operating speed, and to generally improve machines for severing and attaching fastener elements to a tape.

A more specific object is to eliminate the use of spring pads ordinarily forming a part of the die. This is done by providing the severing punch with a cross-bar at its lower end so that the punch when rising, will itself function to lift the strip of material to the desired elevation, preparatory to feeding the same through the die toward the tape. Still another object is to make it possible to grind or sharpen the punch throughout most of its working length, despite the provision of the aforesaid cross-bar at the bottom end of the punch. The elimination of the heavy spring pad contributes to reduced inertia and faster operation, and a further object of the invention is to appropriately and commensurately increase the operating speed of the feed means for the strip of embryo elements, this also being done, generally, by reducing inertia effects in the feed means. Another object is to simplify the structure of said feed means.

To the accomplishment of the foregoing general and other more specific objects, which will hereinafter appear, my invention consists in the apparatus elements and their relation one to the other, as hereinafter are more particularly described in the specification, and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a side elevation of apparatus embodying features of my invention;

Fig. 2 is a partially sectioned plan view of the same with the ram, ram housing, rocker arm, and tape feed mechanism removed;

Fig. 3 is a section taken in elevation approximately in the plane of the line 3—3 of Fig. 2;

Fig. 4 is a similar section through the punch and ram housing, drawn to elarged scale, this section being taken approximately in the plane of the line 4—4 of Fig. 5;

Fig. 5 is a horizontal section taken approximately in the plane of the line 5—5 of Fig. 4;

Fig. 6 is a partially sectioned front elevation of the punch, looking in the direction from the cam shaft toward the ram and ram housing;

Fig. 7 is a section through the punch and ram, but showing the relation of the parts after long wear of the punch;

Fig. 8 is a side elevation of the punch and ram shown in Fig. 7;

Fig. 9 is a section through the feed lever and lock for the same, said section being taken approximately in the plane of the line 9—9 of Fig. 2;

Fig. 10 shows a part of Fig. 9, but with the feed lever unlocked;

Fig. 11 is a section taken in the same plane as Fig. 3, but showing the feed movement with the parts drawn to enlarged scale;

Fig. 12 is a similar view showing the cutting operation;

Fig. 13 is a similar view but showing the return movement of the parts;

Fig. 14 is a similar view, but illustrates the parts in their end position, preparatory to the next feed movement;

Fig. 15 is a horizontal section through the punch, and shows the strip of embryo fastener elements being operated on thereby; and

Fig. 16 is a plan view of the complete apparatus.

Referring to Figs. 1 and 15, the strip of embryo fastener elements 12 is unwound from a reel 14 supported on a suitable stand 16. The unwinding operation is preferably gravity controlled to provide a loop of slack 18, this loop being controlled by an arm 20 pivoted at 22 and carrying a rotatable, spool-like weight 24. The strip 18 is fed into an attaching machine generally designated 26, said machine comprising means to intermittently feed the strip 12 in a horizontal direction toward a vertically disposed tape 28, said tape being intermittently fed by a tape feed wheel 30. The tape with the fastener elements runs through a guide tube 32 into a basket 34. The vertically reciprocable punch which severs the individual elements from the strip is carried in a ram housing 36 and is actuated by a rocker arm 38. All of the parts of the machine are operated by a main cam shaft 40 driven by a motor. The cam shaft, motor, and tape feed mechanism, etc., need not be described in detail, as they are substantially the same as those described in my Patent No. 2,201,068, issued May 14, 1940, and entitled "Manufacture of slide fasteners," and in my Patent No. 2,302,084, issued November 17, 1942, and entitled "Manufacture of slide fasteners."

The reel 14 is restrained somewhat by an adjustable brake 25 carried by stand 16 and bearing constantly against the periphery of reel 14. The static friction of the brake is somewhat greater than the sliding friction when the reel is in motion. The gravitational pull of weight 24 on wire 18 is greater when the weight is in the raised position shown in Fig. 1, than when it is lowered so that arm 20 is more nearly vertical. The consequent operation is that when loop 18 becomes short, as shown in Fig. 1, the weight 24 overcomes the static friction of brake 25, and the weight descends, producing a long loop of wire. When the weight can no longer overcome even the sliding friction, the reel stops, and weight 24 is again raised until it again overcomes the static friction of brake 25.

Referring now to Fig. 15, the strip 12 has a series of projections 42 on its upper face, and a series of recesses on its lower surface, these corresponding to the heads of the embryo fastener elements. The side edges of the strip are serrated as indicated at 44, the serrations corresponding to the ends of spread jaws, these being so widely spread as to receive the heads of the elements therebetween. The punch which operates on the strip 12 is shown in section at 46, and moves into a die 48. The said die is slotted at 50 to receive the beaded edge of the tape on which the fastener elements are to be secured. The endmost element which has just been severed from the strip is indicated at 52, the remainder of the strip being forced downwardly by punch 46, the effective cutting edge of which is indicated at 54, said edge outlining the head of the element. In Fig. 15, the element 52 is shown with the jaws still in spread condition, it being understood that the machine includes a pair of clamping jaws (shown at 56 in Figs. 2 and 3) which move sidewardly to close the jaws around the bead of the tape, thereby bringing the outer edges of the jaws into substantially parallel formation.

Referring to Figs. 2 and 3 of the drawings, it will be seen that the clamping jaws 56 are located immediately above the die 48. In Fig. 2, the punch has been removed from the die, and the ram and ram housing have also been removed. The tape and the element strip are also omitted. The clamping jaws 56 are carried on levers 58 pivoted at 60 and having cam rollers 62 received between cylindrical cams 64, said cams being carried by the main cam shaft 40 previously referred to.

Referring to Fig. 3, the punch 46 is secured in a ram 66 which is vertically reciprocable in ram housing 36. The ram is raised by a compression spring 68 bearing against a stud 70 projecting from ram 66. The ram is operated by a birfurcated rocker or ram lever 72 pivoted at 74, and carrying cam rollers 76 at its bifurcated lower end. The ram lever is preferably made of duralumin or equivalent light-weight metal. These cam rollers engage cams 78 which are mounted on cam shaft 40. The opposite end of the ram lever is provided with an adjusting screw 80 the lower end of which bears against a hardened wear plate 82 at the top of ram 66. The purpose of screw 80 is to readjust the position of the ram to compensate for wear when the lower end of punch 46 is ground or sharpened.

The feed means for the element strip (not shown) comprises a cam 84 (Fig. 2) working against a cam roller 86 mounted on one end of a feed lever 88, said lever being pivoted at 90 and carrying a feed dog 92 at its opposite end. The lever 88 is preferably made of duralumin or equivalent light-weight metal in order to minimize its inertia. A compression spring 94 holds cam roller 86 against cam 84. This spring may be adjusted by means of an adjusting screw 96. The feed dog 92 is rigidly secured on arm 88 without any intermediate slide or similar guide means to insure rectilinear motion, these parts being omitted in order to minimize the mass of the reciprocating parts of the feed mechanism. Furthermore, the dog 92 is not pivoted for vertical movement, and instead is provided with a very small insert 98 (Fig. 3) which is pivoted on the main dog 92. This insert is normally urged downwardly into engagement with the element strip by means of a spring 100 (Fig. 2) connected to an arm 102 projecting upwardly from the spindle 104 in which insert 98 (Fig. 3) is carried.

The angular movement of the feed lever 88 is comparatively slight, and while the dog 92 is rigidly secured to the end of the feed lever, the resulting sideward movement of the feed dog and feed tooth is small enough to be accommodated by simply permitting such sideward movement. The feed tooth is made without side walls which would engage the sides of the element strip, and is made somewhat wider than the projections on the element strip so as to remain in engagement therewith during any such sideward movement.

The element strip is held against backward movement during return movement of the feed dog, by means of a check dog or strip lock 106 (Fig. 3), this comprising an insert carried by a spindle 108 which in turn has an upwardly extending arm 110 (Fig. 2) to which a pull spring 112 is connected.

The punch and ram construction is shown in greater detail in Figs. 4 through 8 of the drawings. The punch 46 carries a cross-bar 114 at its lower end, this cross-bar being secured to side extensions or heels 116 (Fig. 6) which extend below the cutting edge 118 of the punch. The cross-bar 114 closes the lower end of the punch, thereby forming a window or passage 120 through the punch, said passage being dimensioned to receive the element strip being operated on by the punch. As a result of this construction, the punch functions not only to shear the element strip downwardly away from the endmost element resting on the die 48 (Fig. 4), but also to thereafter lift or restore the element strip to initial position preparatory to feeding the next element (the new end of the strip) over the die 48.

The cross-bar 114 is preferably detachably secured to the punch in order not to interfere with grinding or sharpening of the punch when it has been dulled. The punch is preferably made of uniform cross-section throughout its length so that it may be resharpened many times, and much of its length usefully employed. With this same object in view, the cross-bar 114 is preferably secured to the punch by means of a pair of long, slender screws 122 which pass upwardly through holes running through the heels of the punch and extending upwardly throughout the entire length of the punch. The threaded upper ends of these screws are received in a block 124 mounted at the top of the punch and bearing against the end part 126 of the aforesaid stud 70. The stud 126 applies the operating force of ram 66 to the punch 46, although the punch is additionally secured to the ram by rows of set screws 128. The ram 66 is slidable in ways 130 (Fig. 5) which are themselves mounted on ram housing 36 by means of screws 132. These are received in over-sized holes, thus affording adjustment of the ways 130 under control of adjusting screws 134.

It has already been mentioned that the screw 80 (Fig. 4) on the rocker or ram lever 72, may be adjusted to compensate for grinding the cutting edge of punch 46. After extensive wear, the punch is reset in the ram, and for this purpose the ram is provided with a series of spaced threaded holes 136, 138 and 140. The spacing between these holes may, for example, be one-half inch, in which case the range of adjustment of the screw 80 should be one-half inch or nearly that.

Referring to Figs. 7 and 8, I there show the punch in its lowermost position on the ram, this position being reached only after more than half the length of the punch has been ground away. The force of the ram is applied to the block 124 at the upper end of the punch, by means of a square-headed stud 142, said stud being received in the hole 140. It will be understood that in intermediate stages of punch wear, the stud 142 is positioned in the hole 136, then in the hole 138, and finally in the hole 140.

The screws holding the cross-bar 114 have been changed, the screws 122' being like the screws 122, but shorter. Several pairs of such screws are used, preferably in lengths corresponding to the step-by-step movement of the stud 142. These screws are threaded far enough to accommodate the small, individual sharpenings or grindings of the punch, the upper ends of the screws projecting through the bar or nut 124 as the punch is worn. Theoretically, there is no reason why the original pair of long screws 122 might not be used, these screws then being threaded nearly throughout their length, but because of the extremely long, slender nature of the screws, I prefer to thread the same for only a limited distance, and to use other screws of shorter length as the punch is more extensively worn.

Theoretically, the holes in the punch might be tapped or threaded for the reception of short screws. However, this would have to be done for the full distance before hardening the punch, and I prefer not to even attempt so difficult a threading operation.

Referring now to Figs. 2, 9 and 10 of the drawings, the feed lever 88 may be locked in its outer position, thereby interrupting the feed of the element strip 12. As will be understood by those skilled in the art, this is done in order to provide gaps in the elements secured to the tape, these gaps being, say, two inches long, so that the tape may be severed into individual stringers each having about an inch of spare tape at its ends. A suitable counter is schematically indicated at 144 in Fig. 2, this being operated by link 146 connected to a crank pin 148 on cam shaft 40. The counter may be of the type shown in U. S. Letters Patent No. 2,167,259, issued July 25, 1939, and entitled "Counter." In said patent, a circuit is closed for energizing a solenoid-controlled mechanism during the gap-spacing interval. Such a mechanism is shown in my aforesaid Patent No. 2,201,068. A modified and improved solenoid mechanism, which may be responsive to same counter mechanism, is employed with the present apparatus.

Referring to Fig. 9, a solenoid 150 is mounted beneath the table 152 of the machine, with its core 154 movable vertically. In Fig. 9, it is shown in the elevated position which it assumes when the solenoid is energized. The core is connected by means of a screw 156 to a lock 158, the upper end 160 of which is moved into the path of the feed lever 88. In order to avoid wear, a hardened wear plate 162 is preferably secured at the bottom of the feed lever 88, but this moves with and stationary wear plate 164. In Fig. 10, the rod 158 is shown in the dropped or lowered position which it assumes when the solenoid is deenergized, and at this time the upper end 160 is disposed beneath the hardened stationary wear plate 164 on which the movable wear plate 160 rides. The wear plate is fixed on top of a boss 166 cast integrally with the machine table 152. The rod 168 carried in feed lever 88 is the shaft or spindle on which the cam roller of the feed lever rotates.

The operation of the machine may be described with particular reference to Figs. 11 through 14 of the drawings, which show successive stages in the operating cycle. In Fig. 11, the element strip 12 is being fed forwardly to bring the jaws 52 of the endmost element astride the beaded edge 170 of the tape 28. At this time the punch 46 is in elevated position, and the strip 12 is being fed forwardly by movement toward the right of feed dog 92 and tooth 98. The forward end of strip 12 is elevated by the punch cross-bar 114, and this elevation is so adjusted as to raise the strip slightly from the surface of the die 48 in order to permit the strip to be fed over a locating pilot 172 forming a part of die 48 and projecting upwardly therefrom. This pilot is adapted to be received in the recess at the bottom of the endmost element in order to properly locate the element during the cutting operation. As strip 12 is fed toward the right by feed tooth 98, the strip lock 106 rises to pass over the projection 174.

Fig. 12 illustrates the cutting operation. The endmost element is resting on die 48, the recess at the bottom of the element being disposed on the pilot 172 previously referred to. The end portion of strip 12 has been flexed downwardly slightly (the curvature is exaggerated in the drawings) by the shearing action of punch 46, which is now in its lowermost position. The locking tooth 106 is disposed behind the projection 174 of strip 12. Although the clamping jaws (56 in Fig. 2) are not shown in this figure, it will be understood that they are operated to clamp the element jaws 52 around the tape bead 170 while the element still rests on die 48. Element jaws 52 seem shortened in Fig. 12 because they are assumed to be still in angular or spread position.

Fig. 13 illustrates the return movement of the punch and feed dog. Punch 46 has risen partway. The element strip now rests on and has been raised slightly by the cross-bar 114. The tape 28 has also experienced part of its upward feed movement, thereby lifting the clamped element 52 upwardly somewhat from die 48. The feed dog 92 has moved part of its return stroke toward the left, the feed tooth 98 rising to pass over the projection 176. The strip is locked by strip lock 106.

Fig. 14 shows the parts in their end position. The strip lock 106 still bears against the projection 174. The feed tooth 98 has moved well back of the projection 176, the feed stroke of tooth 98 being made slightly greater than the pitch of the element wire. The punch cross-bar 114 has raised element strip 12 to a position high enough to clear the pilot 172 of die 48. The previously attached element 52 has been carried up far enough by movement of the tape 28 to properly space the next element therefrom.

The next stage in the operation of the machine may, of course, be illustrated by reverting to Fig. 11, in which the strip is being fed toward

It is believed that the construction and operation, as well as the advantages of my improved apparatus for making slide fasteners, will be apparent from the foregoing detailed description thereof. The machine is simple, has a minimum of parts, and these are given as short a stroke as possible, and are minimized in mass, thus giving the machine a high operating speed. The punch cross-bar replaces the usual elaborate, complex spring pad arrangements. Despite the use of this cross-bar, the punch may be sharpened or reground, and in fact, this may be done repeatedly so as to use a substantial part of the length of the punch. The strip feed mechanism, as well as the punch and die mechanism, are simplified and lightened, in order to reduce the cost and to increase the operating speed of the machine. The strip lock for interrupting the feed of elements to the tape has also been simplified.

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention as sought to be defined in the following claims.

I claim:

1. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die for supporting a fastener element to be cut from a strip of connected fastener elements, means to intermittently feed the strip, a punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die surface, said punch having downward extensions at the sides of the strip and having a cross bar secured to the lower end of said extensions thereby forming a passage through the punch in which the aforesaid strip is received, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the die.

2. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die including an upwardly projecting pilot for properly locating a fastener element to be cut from a strip of connected fastener elements, means to intermittently feed the strip, a punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die surface and pilot, said punch having downward extensions at the sides of the strip and having a cross bar secured to the lower end of said extensions thereby forming a passage through the punch in which the aforesaid strip is received, said die being devoid of spring pads or the like and the cross bar of the punch being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the die and pilot.

3. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die supporting a fastener element to be cut from a strip of connected fastener elements, means to intermittently feed the strip, a punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die, said punch having heels extending downward at the sides of the strip of the punch, a cross bar at the lower end of the punch, slender screws passing vertically through the cross bar and heels in order to detachably hold the cross bar in position so as to permit grinding or sharpening of the lower end of the punch, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the die.

4. Apparatus comprising a stationary die for supporting an element to be cut from a strip of connected elements, means to intermittently feed the strip, a punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die, said punch having heels extending downward at the sides of the strip, holes extending through said heels longitudinally of the punch all the way to the upper end of the punch, a cross bar at the lower end of the punch, long slender screws passing upwardly through the cross bar and through said holes to a threaded member at the top of the punch, in order to detachably hold the cross bar in position so as to permit grinding or sharpening of the lower end of the punch, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the die.

5. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die including an upwardly projecting pilot for properly locating a fastener element to be cut from a strip of connected fastener elements, means to intermittently feed the strip, a punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die and pilot, said punch having heels extending downward at the sides of the strip, holes extending through said heels longitudinally of the punch all the way to the upper end of the punch, a cross bar at the lower end of the punch, long slender screws passing upwardly through the cross bar and through said holes to an appropriately threaded member at the top of the punch, in order to detachably hold the cross bar in position so as to permit grinding or sharpening of the lower end of the punch, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the pilot and die.

6. Apparatus including a die, means to intermittently feed a strip of connected elements through the die, a relatively long slender punch cooperating with the die for cutting the strip into individual elements, said punch having a uniform cross-section throughout its length, said cross-section being a contoured cross-section to produce a shaped cut, a ram to which the punch is secured, a ram housing slidably receiving the ram, drive means bearing against the top of the ram and including an adjustable screw for varying the position of the ram and with it the punch to compensate gradually for sharpening of the punch, a stud projecting from said ram at the top end of the punch, and a plurality of spaced holes along the ram for receiving said stud in one of a number of different positions to compensate for extensive shortening of the punch, the aforesaid adjusting screw affording a range of adjustment at least equalling the spacing between successive positions of the stud on the ram, the ram housing accommodating a range of movement of the ram at least equalling the stroke of the ram plus the spacing between successive positions of the stud on the ram.

7. Apparatus for the manufacture of slide fastener elements, said apparatus including a die, means to intermittently feed a strip of con-

nected embryo fastener elements through the die, a relatively long slender punch cooperating with the die for cutting the same into individual fastener elements, said punch having a uniform cross-section throughout its length, said cross-section being a contoured cross-section to produce a shaped cut, a ram to which the punch is secured, a ram housing slidably receiving the ram, drive means bearing against the top of the ram and including an adjustable screw for varying the position of the ram and with it the punch to compensate gradually for sharpening of the punch, a stud projecting from said ram at the top end of the punch, and a plurality of spaced holes along the ram for receiving said stud in one of a number of different positions to compensate for extensive shortening of the punch, the aforesaid adjusting screw affording a range of adjustment at least equalling the spacing between successive positions of the stud on the ram, the ram housing accommodating the stroke of the ram plus the spacing between successive positions of the stud on the ram.

8. Apparatus comprising a stationary die for supporting an element to be cut from a strip of connected elements, means to intermittently feed the strip, a relatively long slender punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die, said punch having a uniform cross-section throughout its length, said cross-section being a contoured cross-section to produce a shaped cut, said punch having heels extending downward at the sides of the strip, a cross bar detachably mounted at the lower end of the punch, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the die, a ram to which the punch is secured, a ram housing slidably receiving the ram, driving means bearing against the top of the ram and including an adjustable screw for varying the position of the ram and with it the punch to compensate gradually for sharpening of the punch, a stud projecting from said ram at the top end of the punch, and a plurality of spaced holes along the ram for receiving said stud in one of a number of different positions to compensate for extensive shortening of the punch, the aforesaid adjusting screw affording a range of adjustment at least equalling the spacing between successive positions of the stud on the ram, the ram housing accommodating the stroke of the ram plus the spacing between successive positions of the stud on the ram.

9. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die including an upwardly projecting pilot for properly locating a fastener element to be cut from a strip of connected fastener elements, means to intermittently feed the strip, a relatively long slender punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die and pilot, said punch having a uniform cross-section throughout its length, said cross-section being a contoured cross-section to produce a shaped cut, said punch having heels extending downward at the sides of the strip, a cross bar detachably mounted at the lower end of the punch, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the punch is secured, a ram housing slidably receiving the ram, driving means bearing against the top of the ram and including an adjustable screw for varying the position of the ram and with it the punch to compensate gradually for sharpening of the punch, a stud projecting from said ram at the top end of the punch, and a plurality of spaced holes along the ram for receiving said stud in one of a number of different positions to compensate for extensive shortening of the punch, the aforesaid adjusting screw affording a range of adjustment at least equalling the spacing between successive positions of the stud on the ram, the ram housing accommodating the stroke of the ram plus the spacing between successive positions of the stud on the ram.

10. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die including an upwardly projecting pilot for properly locating a fastener element to be cut from a strip of connected fastener elements, means to intermittently feed the strip, a punch for operating on said strip and for shearing the same downwardly away from an element left on the stationary die surface, said punch having heels extending downward at the sides of the strip, holes extending through said heels longitudinally of the punch all the way to the upper end of the punch, a cross bar at the lower end of the punch, long slender screws passing upwardly through the cross bar and said holes to an appropriately threaded member at the top of the punch in order to detachably hold the cross bar in position so as to permit sharpening of the lower end of the punch, said cross bar being so located that it raises the strip to elevated position after the cutting operation and preparatory to the next feed movement of the strip over the pilot and die, a ram to which the punch is secured, a ram housing slidably receiving the ram, driving means bearing against the top of the ram and including an adjustable screw for varying the position of the ram and with it the punch to compensate for sharpening of the punch, a stud projecting from said ram at the top end of the punch, and a plurality of spaced holes along the ram for receiving said stud in one of a number of different positions to compensate for extensive shortening of the punch, the aforesaid adjusting screw affording a range of adjustment at least equalling the spacing between successive positions of the stud on the ram.

11. Apparatus for the manufacture of slide fasteners, said apparatus including a punch and die for operating on a strip of connected embryo fastener elements having projections, and high speed feed means for intermittently feeding said strip, said feed means comprising a cam, a pivoted feed lever having a cam roller bearing against the cam, a feed dog mounted directly on said feed lever, a very tiny feed tooth pivotally mounted on the end of said feed dog, and resilient means urging said feed tooth into engagement with the projections on the strip, whereby the horizontally reciprocable mass is minimized by the omission of slides or the like for carrying the feed dog, and the transversely reciprocable mass is minimized by localizing the same to the relatively minute feed tooth.

12. Apparatus for the manufacture of slide fasteners, said apparatus including a punch and die for operating on a strip of connected embryo fastener elements having projections, and high speed feed means for intermittently feeding said strip,

lever made of duralumin or equivalent light-weight metal and having a cam roller bearing against the cam, a feed dog fixedly mounted directly on said feed lever at a point immediately over the strip, a very small hardened feed tooth pivotally mounted on the end of said feed dog, and resilient means urging said feed tooth downwardly into engagement with the projections on the strip, whereby the horizontally reciprocable mass is minimized by the light-weight feed lever and the omission of slides or the like for carrying the feed dog, and the vertically reciprocable mass is minimized by localizing the same to the relatively minute feed tooth, said tooth being slidable transversely of the projections on the element strip.

13. Apparatus for the manufacture of slide fasteners, said apparatus including a punch and die for operating on a strip of connected embryo fastener elements, feed means for intermittently feeding said strip, said feed means comprising a cam, a horizontal feed lever having a cam roller bearing against the cam, a feed dog moved by said feed lever for engaging and moving the strip, and means to interrupt feed of the element strip for gap spacing, said means comprising a locking pin slidable vertically into an upward position for engaging the feed lever when the cam has moved the lever to outermost position, a solenoid beneath said locking pin, and a solenoid core connected to said locking pin, the arrangement being such that energization of the solenoid moves the core and locking pin upwardly into position to lock the feed lever, said core and pin being gravitationally moved downward out of the path of the feed lever when the solenoid is deenergized.

14. Apparatus for the manufacture of slide fasteners from a strip of integrally connected embryo fastener elements, said apparatus comprising a reel of element strip, means to rotatably support the same, brake means to resist too free unwinding of the reel, punch and die means to sever the element strip into individual elements, feed means to intermittently feed the strip, and means to maintain a loop of relatively slack wire between the reel and the feed means, said means comprising an arm pivoted at one end and carrying a rotatable grooved weight at the opposite end, said weight resting on said element strip, and said arm being so located that it is moved upwardly toward a horizontal position when the loop of element strip is shortened, and is lowered toward a vertical position when the loop of element strip is lengthened, the brake being so adjusted that its static friction is overcome by the weight when the weight arm is moved toward horizontal position.

GEORGE WINTRISS.

DEFENDANT'S EXHIBIT "BH"

F. Ulrich Patent No. 2,370,380

Filed Mar. 28, 1939 Patented Feb. 27, 1945

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MACHINE AND METHOD FOR MAKING SLIDE FASTENERS

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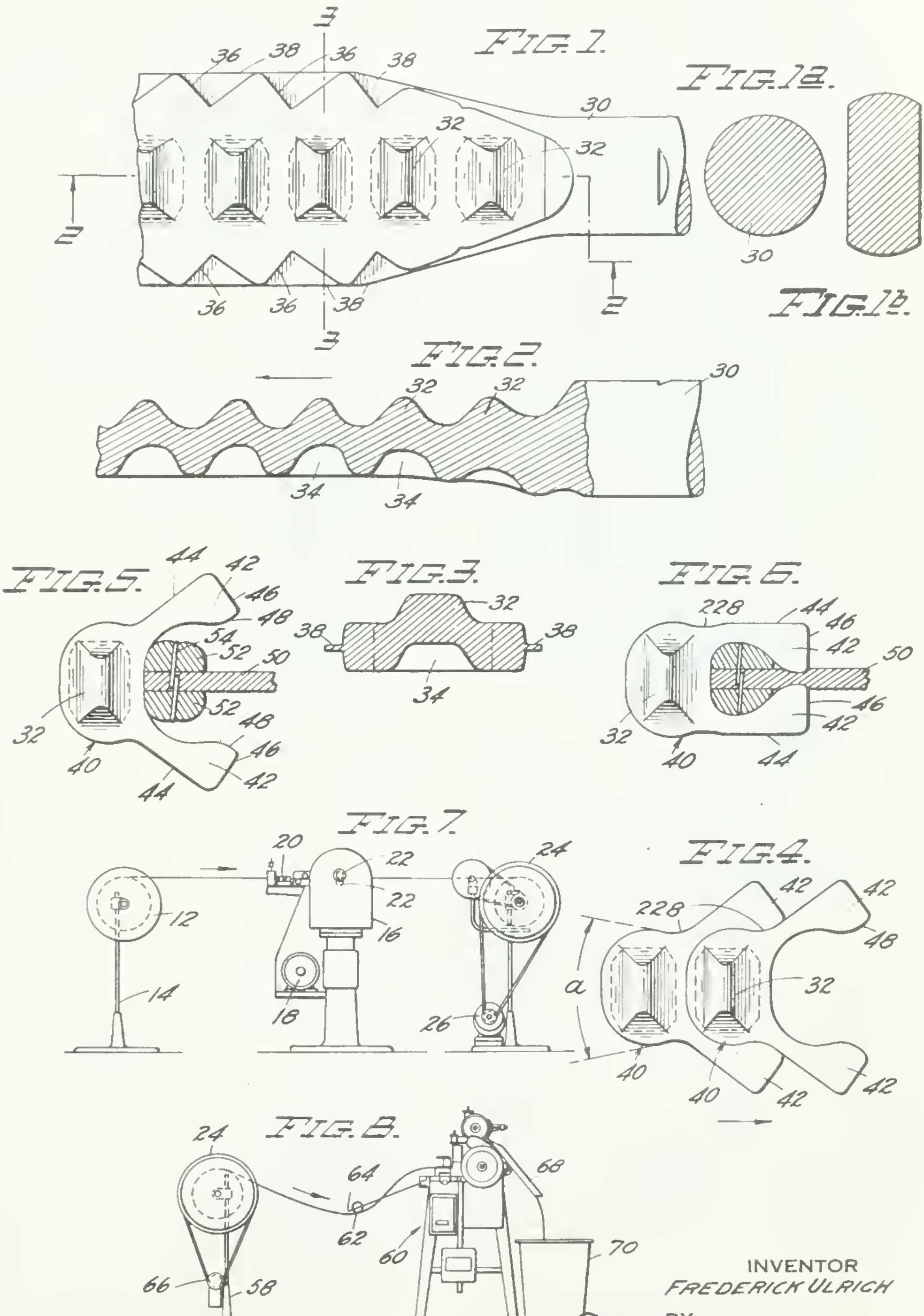

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MACHINE AND METHOD FOR MAKING SLIDE FASTENERS

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FIG. 1.

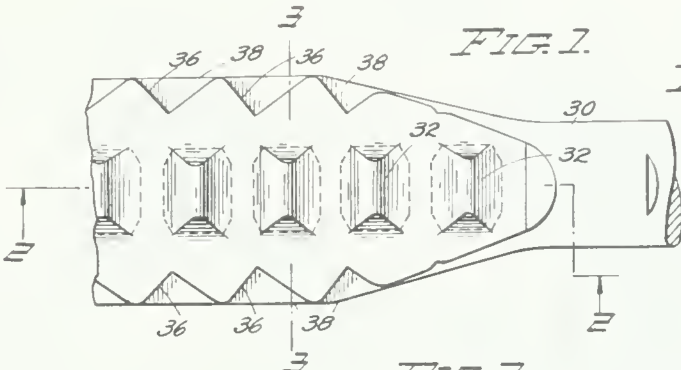
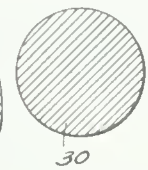


FIG. 1a.



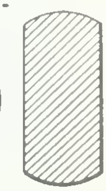


FIG. 1b.

FIG. 2.

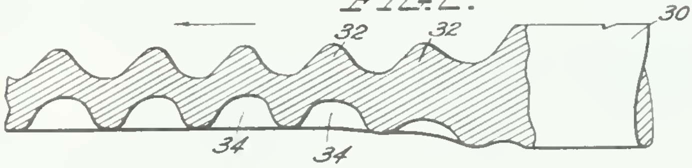


FIG. 5.

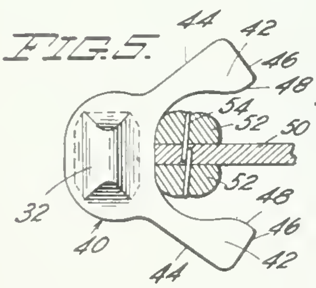


FIG. 3.

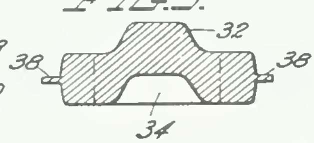


FIG. 6.

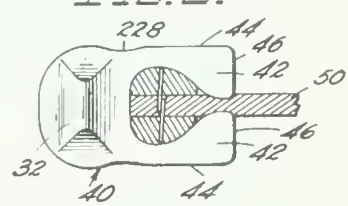


FIG. 7.

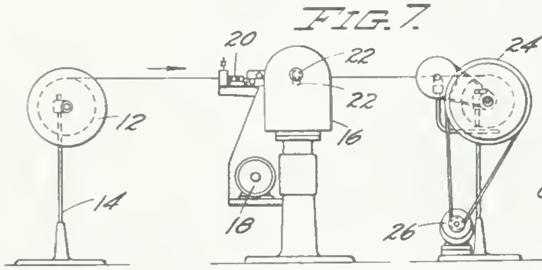


FIG. 4.

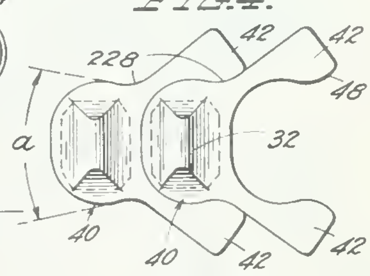


FIG. 8.

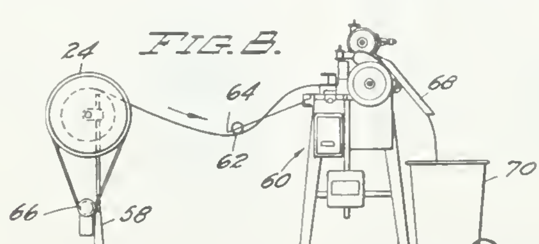


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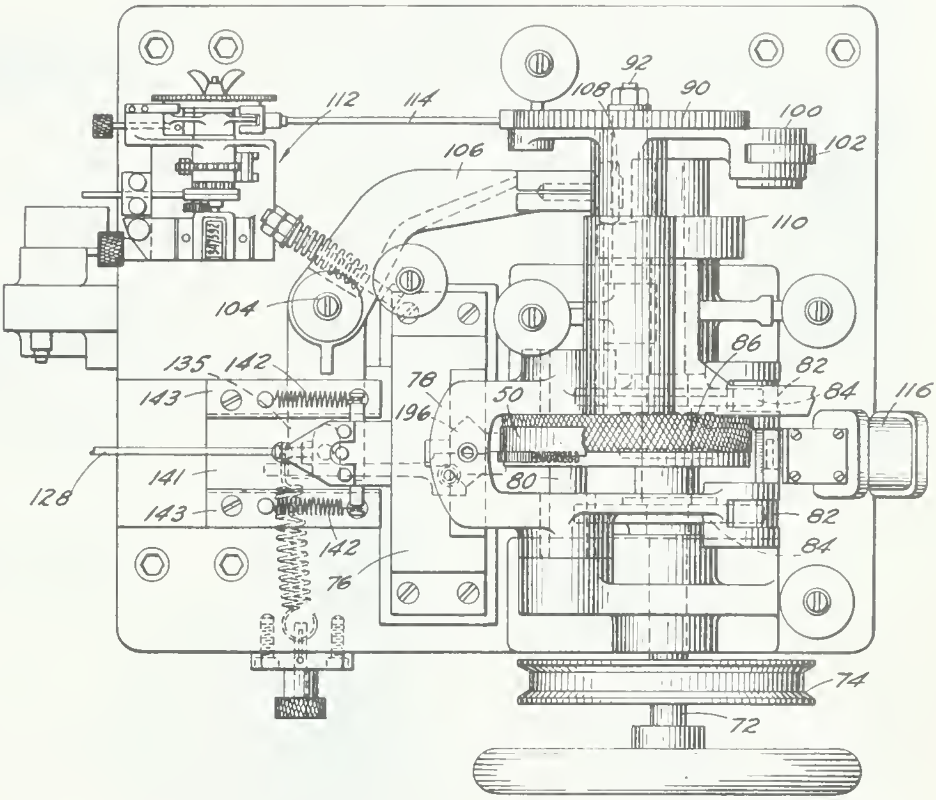
FIG. 9.



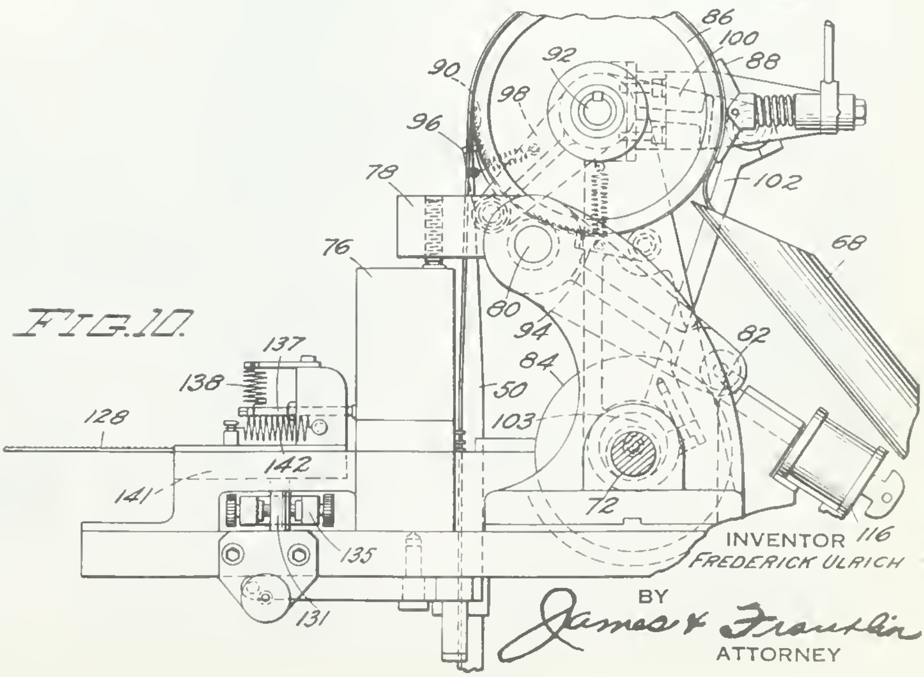


FIG. 10.

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FIG. 11

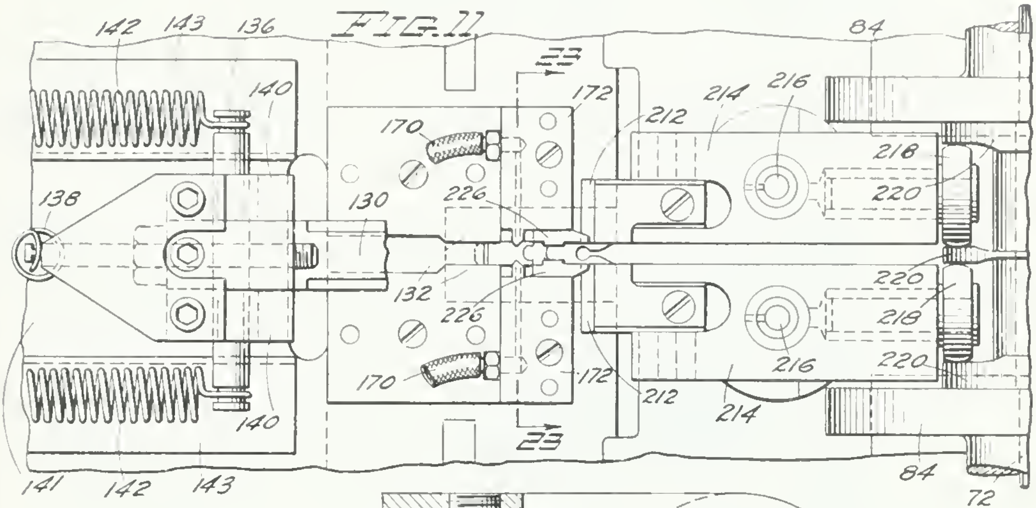

FIG. 12.

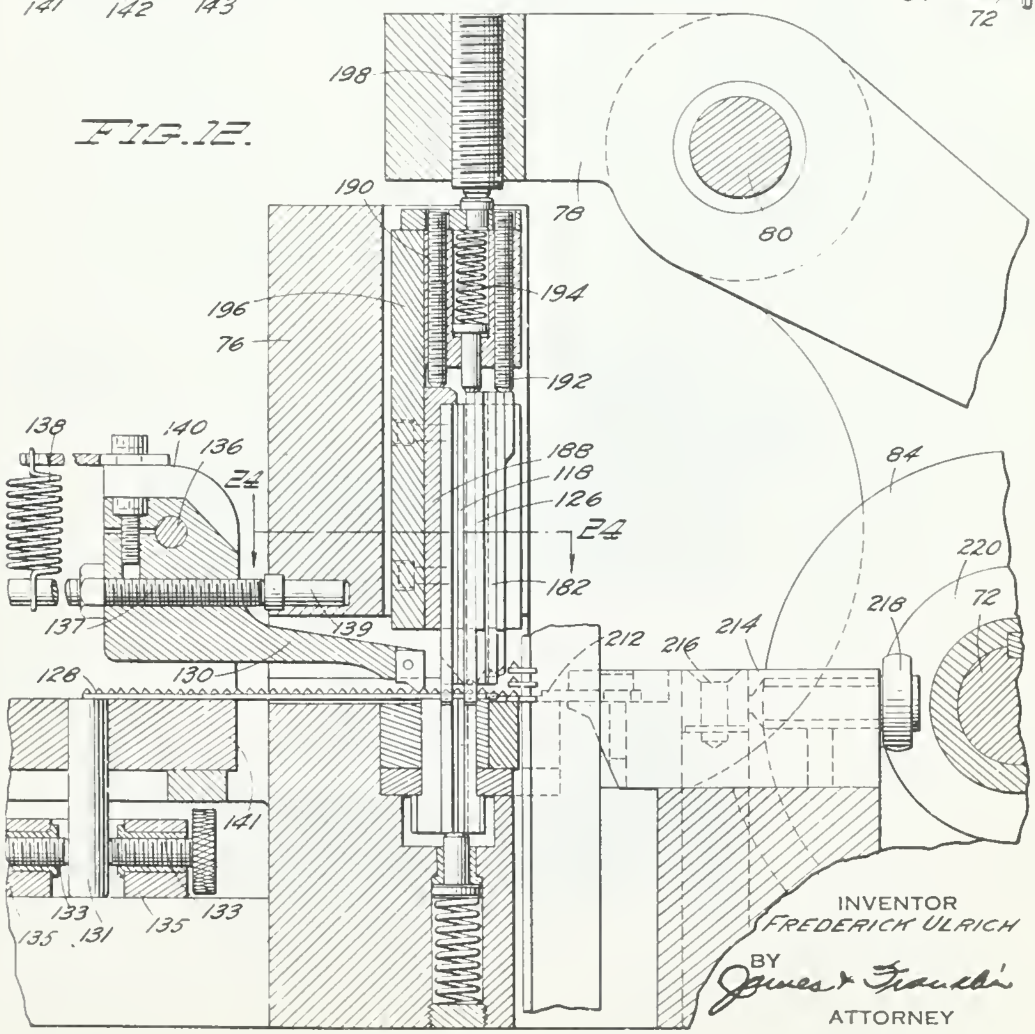

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FIG. 13.

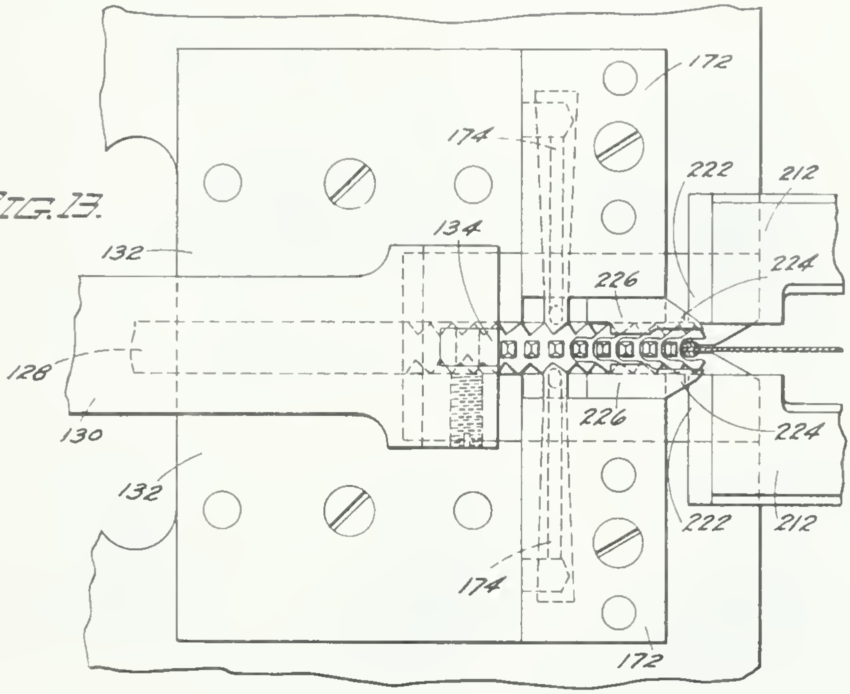


FIG. 14.

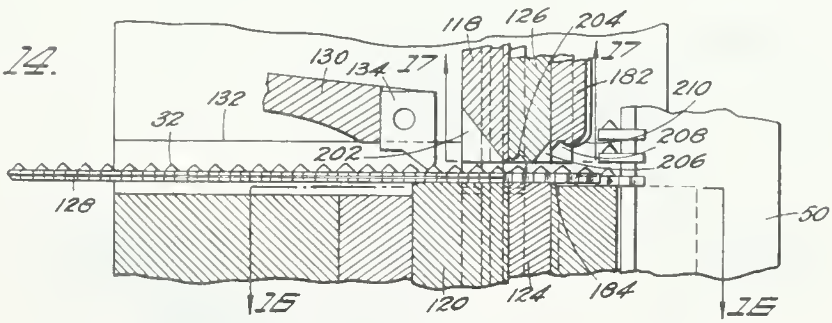
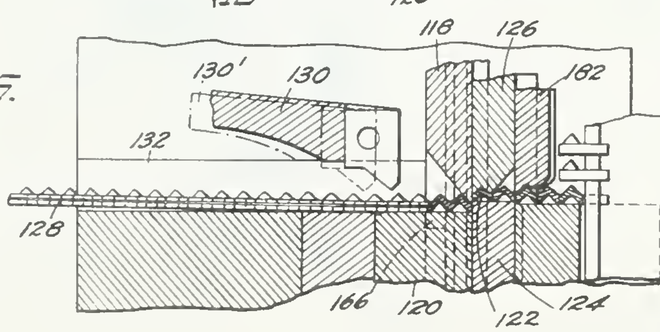


FIG. 15.



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MACHINE AND METHOD FOR MAKING SLIDE FASTENERS

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FIG. 16.

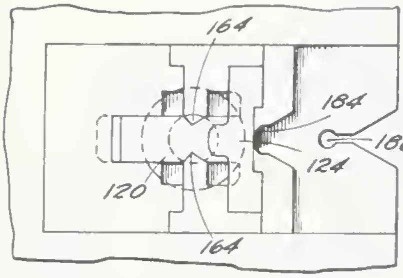


FIG. 17.

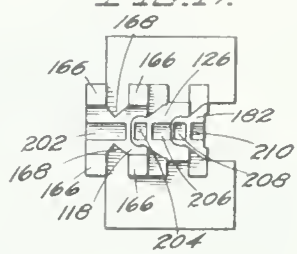


FIG. 18.

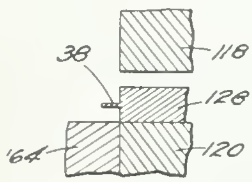


FIG. 19.

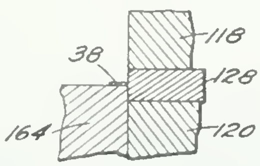
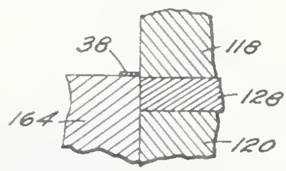


FIG. 20.



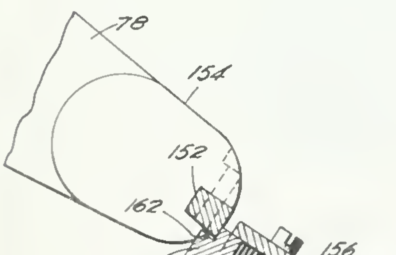
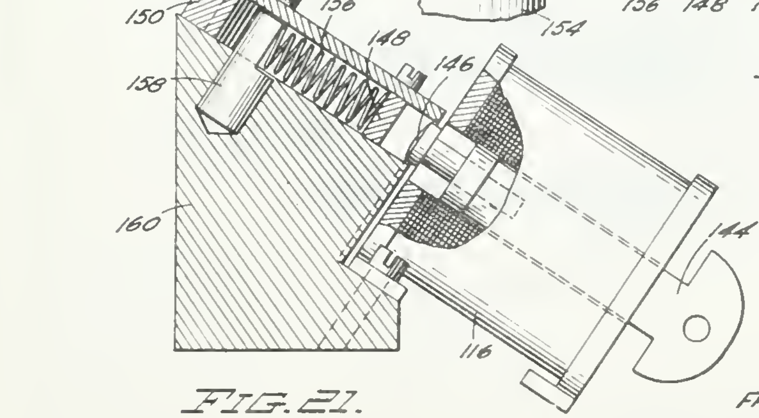



FIG. 21.

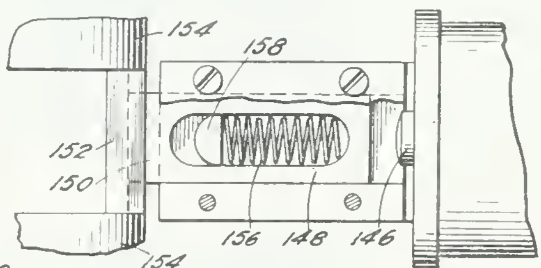


FIG. 22.

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FIG. 23.

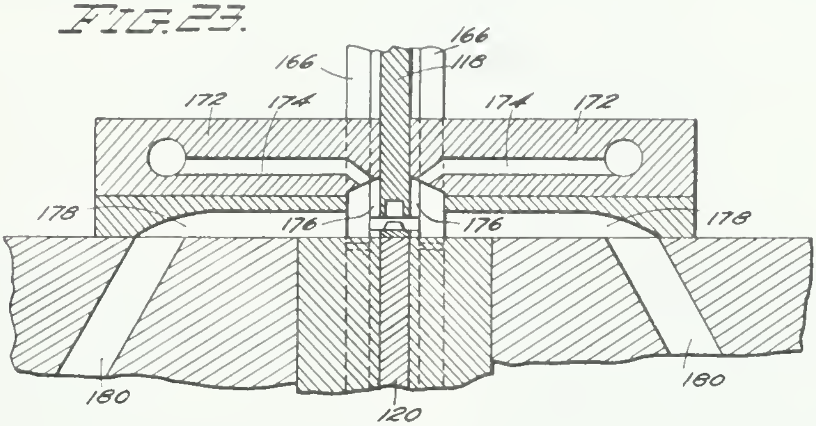


FIG. 24.

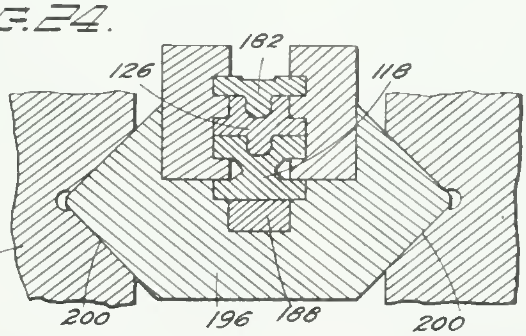


FIG. 25.

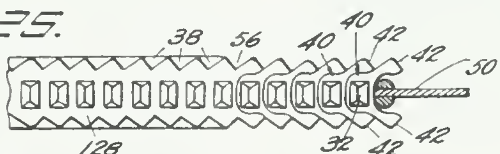


FIG. 26.

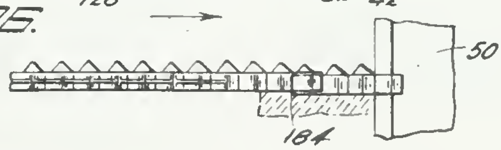


FIG. 27

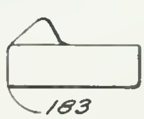
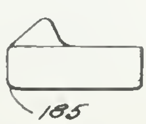


FIG. 28.



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Patented Feb. 27, 1945 2,370,380

UNITED STATES PATENT OFFICE

2,370,380

MACHINE AND METHOD FOR MAKING SLIDE FASTENERS

Frederick Ulrich, Bayonne, N. J., assignor to Conmar Products Corporation, Bayonne, N. J., a corporation of New Jersey

Application March 28, 1939, Serial No. 264,550

29 Claims. (Cl. 153—1)

This invention relates to slide fasteners and the manufacture thereof.

The ordinary methods of manufacturing standard slide fastener elements involve considerable scrap or waste material, due to the irregular configuration of the element when in open-jawed condition.

The primary object of my invention is to generally improve the manufacture of standard slide fastener elements, particularly with a view to increasing the efficiency and economy of manufacture, and still more specifically with a view to minimizing scrap or waste to a negligible amount while making and handling the material for the elements as a continuous wire. A further object is to make the invention applicable to raw stock of the most conventional and inexpensive character as, for example, a simple round wire of uniform diameter.

Still another object of my invention is to apply the improvement features thereof to the general process disclosed and claimed in co-pending application, Serial No. 215,180, filed by George Wintritz on June 22, 1938, now Patent No. 2,201,068, of May 14, 1940, and entitled "Manufacture of slide fasteners," which process is a most efficient, advantageous and desirable one, despite the single disadvantage that it involves the production of considerable scrap or waste, that disadvantage being eliminated as the main object of the present invention. This object is fulfilled by so shaping the elements that the jaws are so widely spaced and spread, and so shaped as to form a space therebetween large enough to receive the head of the next element, the jaws having diverging outer sides adapted to be brought into substantially parallel relation when the jaws are closed, and having ends converging at such an angle that when the jaws are closed on the tape the ends come perpendicular to the tape.

Further objects of my invention center about the mechanism for feeding the wire toward the tape. In accordance with the present invention, I provide a feed dog which is reciprocable in the direction of feed, but which is prevented from moving downwardly by suitable guides. The severing punch bears against the wire in back of the endmost element being severed from the wire, said punch moving the wire downwardly against the resistance of a spring pad. The timing of the machine is such that the wire is held downwardly by the punch during retraction of the feed dog, and is held upwardly by the spring pad during forward movement of the feed dog, thus providing intermittent feed without necessitating the use of a check dog or holding dog. In accordance with still another feature of the invention, the feed of wire toward the tape is interrupted when providing a gap or space between stringers, by holding the punch downwardly during the spacing operation. In the particular apparatus described herein, this not only interrupts feed of the wire, but avoids repeated reciprocation of the wire relative to the element last severed therefrom, which in turn avoids wear and loosening of the fit beween successive elements.

In order to provide elements of conventional shape with parallel sides when the jaws are closed on the tape, it is necessary for the elements to have diverging sides while the jaws are open. The wire is accordingly preferably provided with serrated edges. However, the most rapid and economical method of forming the wire is by rolling the same under extremely high pressure between a pair of small diameter rolls as described in the aforesaid Wintritz Patent No. 2,201,068. However, in thus rolling the wire, a thin triangular fin is left in the serrations of the side edges of the wire.

A further object of the present invention is to provide suitable means for trimming or serrating the side edges of the wire, and more specifically, for severing the aforesaid triangular fins from the wire. This operation is preferably performed by the main severing punch, the latter cooperating with appropriate die surfaces which trim the fin from the wire. In accordance with a further feature and object of the present invention, I provide special air blast means so disposed with relation to the punch and die for trimming the wire, that the bits of scrap are dependably blown out of the apparatus into a suitable receptacle.

Other objects of the present invention are to prevent angular disposition of an element caused by a kink in the wire or by pressure of the severing punch, and to make room for a rounding or finishing punch, if desired. For this purpose, a series of already-severed elements may be provided between the end of the wire and the tape. Another object is to properly support and confine such severed elements, and to prevent improper orientation of the same, and further, to prevent longitudinal separation of the same.

To the accomplishment of the foregoing and other objects which will hereinafter appear, my invention consists in the method steps and apparatus elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a plan view of a piece of wire having a part formed in accordance with the present invention;

Fig. 1a shows the section of the round wire before rolling;

Fig. 1b is a section through a flat wire which may be used instead of round wire;

Fig. 2 is a longitudinal section taken in the plane of the line 2—2 of Fig. 1;

Fig. 3 is a transverse section taken in the plane of the line 3—3 of Fig. 1;

Fig. 4 shows the relation of the elements when severed;

Fig. 5 illustrates the application of an element to the tape before closing of the jaws;

Fig. 6 is a similar view after closing of the jaws;

Fig. 7 is a side elevation illustrating the apparatus for rolling the wire;

Fig. 8 is a side elevation illustrating the apparatus for severing the wire into individual elements and attaching the same to the tape;

Fig. 9 shows the attaching apparatus in plan;

Fig. 10 shows the upper part of the attaching apparatus in elevation;

Fig. 11 is a plan view of a part of the attaching apparatus drawn to enlarged scale;

Fig. 12 is a section taken in elevation through the punch and feed mechanism;

Fig. 13 is a plan view explanatory of the severing die and the clamping plates;

Fig. 14 is a section through the die with the punches in elevated position;

Fig. 15 is a similar section with the punches in down position;

Fig. 16 is a plan view of the die taken approximately in the plane of the line 16—16 of Fig. 14;

Fig. 17 is an inverted plan view of the punches taken in the plan of the line 17—17 of Fig. 14;

Figs. 18, 19 and 20 are explanatory of the removal of the fin from the wire;

Fig. 21 is a partially sectioned side elevation showing the lock for interrupting the feed of elements to the tape when providing a space between stringers;

Fig. 22 shows the same looking from above;

Fig. 23 is a transverse section through the die, taken in the plane of the line 23—23 of Fig. 11, and illustrates the air blast passages for removal of scrap;

Fig. 24 is a section through the punches, and is taken in the plane of the line 24—24 of Fig. 12;

Fig. 25 shows the wire and the severed elements leading to the tape;

Fig. 26 is a side elevation of the same; and

Figs. 27 and 28 show the element in profile before and after the rounding operation.

The present process may be divided into two stages, as in the aforesaid Patent No. 2,201,068. The first stage is illustrated in Fig. 7, and in this stage a wire is deformed, preferably by rolling the wire under pressure, to form a fastener wire such as is illustrated in Figs. 1, 2 and 3 of the drawings. The stock used may be a simple round or oval wire, or, if desired, it may be a flat or somewhat flattened wire. This wire is taken from a reel 12 supported on a suitable pedestal 14, and is fed through a rolling mill 16, the latter being driven by a motor 18. The mill may, if desired, be preceded by appropriate straightening rolls 20. The rolling mill is not disclosed in detail herein, it being like that disclosed in the aforesaid Patent No. 2,201,068. The wire is rolled in a single passage under high pressure through comparatively tiny or small-diameter pressure rolls 22, and is then reeled up on a suitable reel 24, the latter being turned by motor 26.

Referring now to Figs. 1, 2 and 3 of the drawings, the round wire 30 is flattened, and deformed to provide a comparatively closely spaced series of interlocking means. In the present case the interlocking means are of conventional type, and consist of a projection 32 on one side and a recess 34 on the opposite side of the wire. The side edges of the wire are preferably notched or serrated as is indicated at 36. In using a rolling process with the rolls above and below the wire, it is easier and preferable to leave a fin of metal 38 in the serrations. The nature of this fin is most clearly shown in Fig. 3. The wire of Figs. 1 and 2 may be rolled from flattened wire, as is indicated in Fig. 1b. This places less load on the forming rolls, but I prefer the round wire of Fig. 1a as it is somewhat less expensive. In either case the raw wire stock is a simple smooth wire, and both types are inexpensive compared to specially shaped wires.

The manner in which this wire may be severed to form fastener elements will be clear from inspection of Figs. 4 and 25. In these figures it will be seen that the severed elements comprise a head 40 and widely spread jaws 42. The head portion 40 carries the aforesaid projection 32 on its upper side and recess 34 (Fig. 2) on its lower side. It will be seen on inspection of the drawings that the head of each element is located within and conforms to the jaws of the next element, the head filling the space between the spread jaws. From a more accurate viewpoint, it may be said that the jaws 42 are so widely spaced or spread apart and are so shaped on the interior, as to form a space therebetween large enough to receive the head 40.

The shape of the exterior of the jaws is also important. In Fig. 5, I show the individual element severed from the wire and moved against the beaded edge of a tape. When the jaws are closed, the element is attached to the tape as shown in Fig. 6. Comparing Figs. 5 and 6, it will be seen that the outer edges 44 of the jaws change from a very divergent position to parallel position, and furthermore, are spaced apart an amount equal to the width of the head 40. The end walls 46 of the jaws are preferably disposed substantially perpendicular to the outer edges 44, so that when the jaws are closed the ends 46 form a surface which is substantially perpendicular to the tape, as is shown in Fig. 6. When the element is completed and fastened to the tape, it does not differ noticeably from elements made by the more conventional wasteful methods except, perhaps, for the shape of the opening between the jaws receiving the beaded edge of the tape. This, however, is not normally visible.

At the inside the jaws are preferably provided with short walls 48 which preferably extend generally parallel to the outer walls 44 and generally perpendicular to the end walls 46. With this arrangement, the inside walls 48 bear directly against the tape when the jaws are closed, as shown in Fig. 6, thus providing a substantial bearing surface to prevent cutting or penetration of the tape. The tape itself may be made in accordance with known methods, it comprising a woven tape 50 having cords 52 stitched on opposite sides at one edge of the tape, as by means of the stitching 54.

In Fig. 25 it will be observed that the fin 38 is removed at the point 56, this preferably being done as a part of the severing operation which cuts the wire into individual fastener elements. Because it is very thin and small in area, the fin constitutes only a very small amount of scrap or waste.

The apparatus for removing the fin, severing the elements and attaching the same to the tape, is shown in Fig. 8. The reel 24 of fastener wire is supported on a suitable stand 58. The fastener wire is taken from reel 24 and fed to the attaching machine 60. A loop of slack 62 may be maintained between reel 24 and machine 60, as by means of a feeler 64 controlling a motor 66 for intermittently unwinding the reel. The attaching machine 60 severs the elements and attaches the same to a tape, the resulting continuous stringer being fed through a discharge tube 68 into a basket 70.

The attaching apparatus is shown in somewhat greater detail in Figs. 9 and 10 of the drawings. The apparatus comprises a timing shaft or cam shaft 72, said shaft carrying pulley 74 belted to a suitable driving motor. The punches are carried by a ram 196 slidable in the guides or ways of a ram housing 76. The ram is reciprocated by a generally U-shaped rocker 78, the two branches of said rocker being pivoted at 80, and the ends of the branches carrying cam follower rollers 82 which cooperate with cams 84 carried by the cam shaft 72. The tape 50 is fed intermittently upward by means of a tape feed drum 86, the tape being held on the drum by means of a shoe 88. Drum 86 is moved by suitable pawl and ratchet mechanism, the ratchet wheel 90 being mounted at the end of shaft 92 carrying the feed drum. There is a holding pawl 94 and a feed pawl 96, the latter being carried on arm 98 pivoted on shaft 92 and having an oppositely extending arm 100 connected by means of a connecting rod 102 to an eccentric 103 on cam shaft 72.

The wire is intermittently fed in a horizontal direction toward tape 50. The feed mechanism will be described in detail later, but at this point it may be observed that the feed dog is reciprocated by means of a feed lever pivoted at 104, the arm 106 of the feed lever carrying a cam follower roller 108 cooperating with a cylindrical cam 110 mounted on cam shaft 72. The apparatus further includes a counter generally designated 112, this counter being connected to the cam shaft by a suitable link 114. After a predetermined number of fastener elements has been attached to the tape, the counter functions to interrupt the feed of the wire toward the tape. This is described in greater detail later, but at present it may be pointed out that the counter operates to energize a solenoid 116 which in turn locks the cam followers 82 of the rocker 78 in elevated position, thereby interrupting the reciprocation of the punches.

The nature of the severing punch and die may be explained with reference to Figs. 14 through 17 of the drawings. The severing punch is indicated at 118. A spring pad 120 is located therebeneath. It should be understood that punch 118 operates by cutting the wire downwardly away from the endmost element, rather than by cutting the element away from the wire. The element 122 (Fig. 15) rests on the top surface of a stationary die member 124. If desired it may be held downwardly by means of a suitable holding and locating pad 126 which is nested alongside the punch, but which is spring-pressed and therefore adapted to yieldably stop as the punch continues its downward cutting stroke. The operation will be apparent by comparison of Figs. 14 and 15. In Fig. 14 the punch 118 and holding pad 126 are shown in elevated position. The fastener wire 128 is supported by spring pad 120, the latter being in elevated position. In Fig. 15, the punch is shown in down position, and it will be seen that while the element 122 is held against die member 124 by means of the locating pad 126, the punch 118 has descended and forced the wire 128 downwardly, together with the spring pad 120, the wire being sheared from the element 122. When the punch again rises, the wire is raised by spring pad 120, thus bringing the jaws at the end of the wire back into the initial position with the jaws encompassing the head of the severed element 122.

Figs. 14 and 15 may also be used to illustrate the feed of the wire 128. The wire is fed by means of a feed dog 130 which bears against the projections 32 on the wire, as is shown in Fig. 14. The dog 130 may be rigid, or may be spring-pressed downwardly, but is prevented from moving lower than the position shown in Fig. 14, by suitable guides or rails 132 on opposite sides of the tooth 134 of the feed dog. The relation of the parts is such that when spring pad 120 is in elevated position, as shown in Fig. 14, the feed dog engages the wire, but when the wire is depressed by punch 118, as shown in Fig. 15, the wire is disengaged from feed dog 130. The timing of the machine at the cam shaft is such that feed dog 130 moves forward while punch 118 is elevated, and moves backward, as from the solid to the broken line position 130′ of Fig. 15, when the punch is down. This construction eliminates the need for a holding dog or check dog, the wire being fed forwardly when engaged by the feed dog, and being held against movement by the punch at all other times. In fact, there is nothing to urge rearward movement of the wire, the wire being disengaged from the feed dog when the latter is moving back. The operation may be made very rapid, for the stroke of the feed dog is small, and is not accompanied by any appreciable vertical movement.

Referring to Fig. 12, the feed dog 130 is pivotally mounted on a pin 136, and is normally urged downwardly by pull spring 138. The pin 136 is carried in bearings 140 forming a part of a reciprocable feed carriage or slide 141 (Figs. 9 and 10) running in guides 143. The slide 141 is normally pulled to retracted position by means of pull springs 142 (Figs. 9 and 11).

A pin 131 (Fig. 12) projects downwardly from slide 141, and is engaged by screws 133 carried in the ends 135 of the feed arm 106 (Fig. 9). These screws provide adjustment of the terminal point of the stroke of feed dog 130. The exact terminal point is accurately determined by adjustment of screw 137, which strikes an insert 139 in block 76. An extension of screw 137 receives the lower end of spring 138.

The manner in which the feed of wire 128 is interrupted to produce a gap or space between stringers will now be apparent, for if the severing punch 118 is locked in its down position (Fig. 15) the wire 128 is held below the feed dog 130, and the latter reciprocates idly without feeding the wire. This is of advantage because of its simplicity and because it eliminates reciprocation of the punch and rocker and associated parts. Moreover, it avoids moving the jaws at the end of the wire repeatedly into and out of engagement with the head of the element last severed. Such repeated reciprocations would tend to wear away metal around the outside of the head and the inside of the jaws, bringing these parts below size, and in any event, producing a very loose fit therebetween instead of the snug, accurate engagement which is now obtained.

In connection with Figs. 9 and 10, it has already been mentioned that the counter energizes solenoid 116, thereby locking the right-hand end of the rocker in elevated position. The mechanism for this purpose is shown in greater detail in Figs. 21 and 22 of the drawings, referring to which it will be seen that on energization of solenoid 116, the core 144 is drawn into the solenoid. The preferably non-ferrous button 146 at the end of the core bears against block 148 and moves the end 150 of the block beneath a suitable bar 152 extending across the ends 154 of rocker 78. The bar 148 is normally retracted by a suitable compression spring 156, said spring being located in a slot cut through the bar, and one end of said spring reacting against a stationary pin 158 projecting into the slot from the stationary block 160 on which the parts are mounted.

In operation, the rocker 78 and with it the bar 152 is reciprocating rapidly. When solenoid 116 is energized the end 150 of the block 148 moves into engagement with bar 152, but cannot come beneath bar 152 until the bar has been elevated by the rise of the cam actuated rocker 78. End 150 then slides beneath bar 152 and holds the rocker arm in locked position until the solenoid is deenergized. The pressure of bar 152 against block 148 is sufficient to prevent the block from moving to retracted position until the rise of the cam again reaches the rocker. This relieves the pressure on the block 148 and it is thereupon retracted by spring 156. In this way the movement of the rocker is in complete cycles, and the rocker cannot be stopped or started in the middle of a cycle. To further insure this result, the working end of block 148 is preferably cut at a slight angle or provided with an undercut, as is indicated at 162, and the lower face of cross-bar 152 is preferably shaped to a mating angle. The slightly undercut relation of the surfaces guards against premature retraction of block 148.

The triangular pieces of fin 38 are preferably removed by the severing punch, the latter cooperating with appropriate stationary parts on the die. Referring to Fig. 16, it will be seen that the die has stationary die surfaces 164 which are pointed or shaped to conform to the desired notches or serrations in the wire. The spring pad 120 is indented to receive the points 164. Referring now to Fig. 17, it will be seen that the severing punch 118 is provided with four heels 166 and that the punch is channeled at 168 between the heels to mate with the die surfaces 164 of Fig. 16. Referring now to Figs. 18 through 20, these figures are fragmentary transverse sections at the die surfaces 164. In Fig. 18 the punch 118 is raised, and spring pad 120 supports the wire 128 in elevated position. At this time the fin 38 is disposed above the stationary die surface 164. In Fig. 19, the punch 118 has descended partially, and has moved wire 128 downwardly with spring pad 120 until the fin 38 rests on stationary die surface 164. In Fig. 20 the punch 118 has moved downwardly to the ends of its stroke, thereby severing the wire 128 from the scrap or fin 38, the latter remaining on stationary die surface 164. The heels 166 of the severing punch 118 (Fig. 17) preferably are of such length as to bear against the pad 120 (Fig. 16) during the cutting stroke, as is shown in Fig. 15. This helps prevent deformation of the wire under the impact of the punch.

The bits of scrap or fin are very tiny, and cannot be discharged gravitationally as with ordinary scrap or waste, because they are on top of the die. They tend to cling to the parts of the apparatus, particularly in the presence of an oil film. In the present apparatus, this difficulty has been overcome by removing the scrap with the aid of a blast of air. Referring to Fig. 11, the compressed air is supplied through flexible pipes 170, these leading into blocks 172 secured directly on top of the die. Referring now to Fig. 23, which is a section taken on the line 23—23 of Fig. 11, it will be seen that the compressed air is led inwardly through passages 174 and is then directed downwardly at the punch 118 and into enclosed chambers 176. The compressed air then flows outwardly through passages 178, carrying the fin or scrap with it, and then downwardly through discharge passages 180 leading to a suitable box beneath the attaching machine for receiving the waste. The compressed air blowing at the sides of punch 118 tends to get between the severed scrap and the punch, and this probably accounts for the success with which the scrap is blown away through passages 178 and 180.

As a refinement which, however, is by no means essential, I prefer to provide the apparatus with a finishing punch or rounding punch, this being indicated at 182 in Figs. 14 and 15. It is moved together with punch 118 and forms a part of the punch assembly. Its purpose is to round the lower edge of the element about the head. I may explain that during the severing operation the periphery of the head is provided with a rather sharp or square corner at the bottom. This is indicated at 183 in Fig. 27. The elements may be left in this fashion, but it is preferable to round the corner, as is indicated at 185 in Fig. 28. For this purpose the elements may be treated after being secured to the tape, as by means of wire brushes. However, this requires an extra operation, and may tend to dirty the tape, and does not round the edge of the element very much. In the present arrangement, the stationary die surface beneath one of the severed elements is depressed and rounded somewhat, as is indicated at 184 in Fig. 26. The rounding punch 182 forces the subjacent element into the die curvature at 184, and thereby rounds the corner of the head. This will also be seen from examination of Fig. 14, the curved surface 184 of the die being shown unoccupied in Fig. 14.

Referring to Fig. 16, the downward step of the die surface is clearly indicated at 184, and it will be seen in this figure that the outline of the step 184 conforms to the exterior outline of the fastener element, and clears the jaws. The elements remain at the slightly lower elevation of the right-hand part of the die surface until they reach the tape, the latter being guided in the tape guide 186.

Reverting to Figs. 25 and 26, it will be seen that in the present apparatus there are five severed elements between the wire 128 and the tape 60. The rounding punch operates upon the middle one of these five elements. The last two elements are always at the lower die level. The third element from the end is initially at the upper die level, but after descent of the rounding punch, is moved to the lower die level. It should be understood that the difference in elevation is very slight indeed, and need only be a matter of $^{15}/_{1000}$ of an inch.

The construction of the punch assembly may be explained with reference to Fig. 12 in which it will be seen that the severing punch 118 is secured to a guide 188, the elevation of the punch being adjusted by means of the screw 190. The rounding punch 182 is adjusted by means of screw 192. The spring pad 126 is nested between the punches 118 and 182, and is yieldably urged downwardly by means of spring 194. The entire punch assembly is carried by a ram 196 which is reciprocable in the guides or ways of ram housing 76. Rocker 78 may be provided with an adjusting screw 198 bearing against the ram. Referring now to Fig. 24, the manner in which the edges of ram 196 are received in guides or ways 200 formed in ram housing 76, will be apparent. The nested relation of the severing punch 118, the spring pad 126 and the rounding punch 182, is also clearly shown.

Before leaving the description of the punch assembly it may be pointed out with reference to Fig. 17 that punch 118 is cut away at 202 to clear the projections on the fastener wire reaching the punch; that the spring pressed pad 126 is recessed at 204 to fit around the projection of the element being severed from the wire, and the pad 126 therefore acts as a locating pad which helps insure a uniform location of the cut or periphery of the head about the projection and recess of the head. The spring pad 126 is cut away at 206 to clear the projection of the next element. The rounding punch 182 is recessed at 208 to fit about the projection of the element being rounded, and this is desirable in order not to flatten or deform the shape of the element during the rounding operation. This punch is also cut away at 210 to clear the projection of the next element.

The shaping of some of these recesses will be clear from inspection of Fig. 14, severing punch 118 being cut away at 202; spring pad 126 being recessed at 204, and cut away at 206; the rounding punch 182 being recessed at 208 and cut away at 210.

The endmost element is clamped on the tape by an oppositely movable pair of clamping plates. Referring to Figs. 11 and 12, the clamping plates 212 are secured to levers 214 pivoted at 216. The opposite ends of the levers carry cam followers 218 which run between cylindrical cams 220, said cams being carried on the main cam shaft 72 of the machine. The cams are so shaped as to oppositely move the clamping plates.

Referring now to Fig. 13, it will be seen that the corners 222 of clamping plates 212 are so located as to engage the jaws of the endmost element and at the same time to clear the jaws of the element next to the end. The clamping plates are thinned to come beneath the ends 224 of guides or rails 226 which guide and confine the already-severed elements. When the clamping plates 212 move together, they compress the spread jaws of the endmost element from a condition such as that shown in Figs. 13 and 5, to the closed condition of Fig. 6.

The provision of a series of severed elements between the wire and the tape, as for example, the five severed elements shown in Fig. 25, is not essential but is of advantage in that it provides room for the locating pad and the rounding punch when used. The use of elements which are severed before being delivered to the tape and clamped thereon is also of advantage in avoiding angular disposition of the elements (viewed in elevation) such as might be caused by a kink in the wire or the pressure of the severing punch.

The advantage of keeping the elements integrally related in the form of a wire is substantially retained when using a group of severed elements of the configuration here employed. In the first place, the elements are confined and guided in a track and between guide walls surrounding the ends of the spread jaws. The elements are prevented from moving to improper orientation because of the manner in which the head of one element is snugly received within the jaws of the next element. Finally, any possibility of longitudinal separation of the elements is prevented by the provision of a slight undercut between the elements when viewed in plan. Thus, referring to Fig. 4, it will be seen that the transverse width of the head is reduced at the point 228, or the sides are non-parallel, as indicated at *a*. In other words, the head is necked or narrowed very slightly and even if an undercut of only a few thousandths of an inch is used, it is adequate to prevent longitudinal separation of the elements. This kind of undercut does not, however, prevent transverse separation of the elements, such as takes place when the endmost element is clamped on the tape, and the tape then moves vertically upward to carry the elements upwardly away from the stationary die and the clamping plates.

It is believed that the method of the present invention, as well as the construction and operation of the apparatus, will be apparent from the foregoing detailed description. Simple, uniform wire stock which may be either round or flattened in section is fed between small-diameter rolls which squeeze the wire under high pressure and which in the course of a single pass through the rolls, deform the wire to provide a series of closely spaced projections and recesses along the same. The side edges are also preferably notched or serrated, either completely, or with a slight remaining fin. The wire is reeled, the reels being used as needed for the attaching machine. There the wire is unreeled and is operated upon by punch and die mechanism which removes the fin or triangular pieces of waste, and which severs the wire into fastener elements so shaped that the head of one element is nested fully within and substantially fills the space within the spread jaws of the next element. This relation of the elements avoids waste of metal. The elements are kept in nested relation and are fed toward an intermittently moved tape where the endmost element is clamped on the tape. If desired, a finishing operation such as that produced by the rounding punch may be applied to the elements between the cutting punch and the tape. The upward movement of the tape disengages the attached element from the next element, whereupon the series is again advanced to bring another element astride the tape.

The many advantages of the invention will also be understood from the detailed description. The main advantage, of course, is that the invention minimizes waste or scrap metal. This is accomplished while using elements of generally conventional type, that is, elements the jaws of which come into substantially parallel relationship when closed. The ends of the jaws are perpendicular to the sides and the tape when closed, and the inner walls of the edges at the ends includes a broad bearing surface for engaging the tape without cutting or penetrating the same. The elements are so crowded or nested together that there are three times as many elements for a given length of wire compared to the practice in Patent No. 2,201,068, previously referred to. This increases the life of the pressure rolls because the rolls produce stock for three times as many elements for each revolution of the rolls. Moreover, the reciprocating strokes in the attaching machine are reduced to a very small amount. The feed of the wire, for example, is only about one-third of that formerly used. The reciprocation of the punch is merely the thickness of the wire. These changes contribute to high speed operation of the attaching machine, and I have successfully operated the attaching machine at a speed of 2400 R. P. M. The manner in which the feed of the wire is interrupted by simply locking the punch rocker with the punch in down position, also contributes to the desired high speed operation. This latter feature prevents reciprocation of the elements into and out of engagement with consequent loosening of the fit therebetween. The use of a series of severed elements between the cutting punch and the tape provides room for the cutting punch and the associated spring pad which holds the element being cut. It also provides room for a finishing or rounding punch. It frees the jaws of the endmost element for the clamping operation, and avoids angular positioning of the element, as by reason of the punch thrust or a bend in the wire. The cutting action used whereby the punch severs the wire from the element instead of vice versa, has the advantage of simplifying the wire feed mechanism; makes it possible to remove the triangular fin or scrap while using only a single cutting operation; and also provides a greater contact area or "land" at the cutting edge of the punch. The sides of the head are non-parallel or converge so as to provide an undercut or interlock of the elements after they are severed and re-engaged, and this prevents longitudinal separation. The nesting of the elements prevents improper orientation as they are moved toward the tape.

It may be pointed out that the strip of metal initially employed may have smooth, continuous edges instead of being notched or serrated, as here disclosed. In such case, the punch and die mechanism will notch or serrate the strip much as here disclosed, the main difference being that the tool will cut through the full thickness of metal instead of merely a thin fin, and in such case the percentage waste or scrap will, of course, be increased.

Going still further, the strip of metal may be a plain flat strip, devoid not only of notches but also of projections and recesses. In such case the apparatus must be modified in a number of respects, the most important of which is the provision of a forming punch to provide the projections and recesses. The rolling apparatus may then be eliminated altogether, and the smooth or "raw" wire is fed directly into the attaching machine. This aspect of my invention is not illustrated or claimed herein, it being fully disclosed and claimed in my copending companion application, Serial No. 264,551, filed concurrently therewith, now Patent No. 2,302,075, patented November 17, 1942.

The said companion or divisional application together with the present application, are continuations in part of my earlier application, Serial No. 179,299, filed December 11, 1937, now Patent No. 2,221,740, of November 12, 1940.

Coming back to the present disclosure, the strip of metal fed to the attaching machine may be more instead of less finished, that is, it may be fully notched or serrated (devoid of fin) when it reaches the attaching machine, and in such case no fin need be removed, and no air blast need be provided. If the wire is initially formed or rolled without a fin, then there is no scrap or waste at all.

The feed dog may be mounted rigidly as disclosed in my aforesaid companion application, (instead of pivotally) because the fastener wire is depressed by the punch during retraction of the feed dog.

It will therefore be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made, without departing from the spirit of the invention defined in the following claims.

In the appended claims, I intend the expression "notched or serrated strip" to include either a fully notched strip or a strip which is substantially notched except for a thin residue or fin of metal as specifically disclosed herein.

In claims dealing with the gap-spacing mechanism, I refer to a "counter," which, of course, may be any such device to determine the length of the stringer or spacing between gaps.

I claim:

1. In the manufacture of slide fastener elements comprising a head and spread jaws connected thereto, said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough to receive the entire head of an identical element, and said jaws being so shaped that when closed the outer edges come into substantially parallel relationship, the method which includes pressing a continuous strip of metal to form a closely spaced series of interlocking means along the entire length of the strip, the interlocking means being so closely spaced as to correspond to a series of embryo elements with spread jaws only if the head of one element is nested fully within and substantially fills the space within the spread jaws of the next element, punching away small triangular pieces of scrap or waste at the side edges of the end of the strip in order to give the end of the strip notched or serrated side edges conforming to the outer ends of spread jaws having the desired shape, and immediately thereafter severing the strip on an outline corresponding to the outline of the head and intersecting the inner angle of the triangular notches at the sides of the strip, in order to define elements of the desired shape without scrap or waste other than the aforesaid triangular pieces of scrap.

2. In the manufacture of slide fasteners, the method which includes providing a wire having a series of interlocking means therealong, the width of the wire equalling that of the desired fastener elements with spread jaws, intermittently feeding a tape transversely of the wire, intermittently feeding the wire toward the tape, severing the end of the wire entirely across the wire in such configuration as to form a fastener element having a head including the interlocking means and having spread jaws, the head being of such dimension as to fully occupy the space between the jaws of the next element, restoring the jaws at the end of the wire and severed element to-

gether again in fully nested relation, intermittently moving the nested severed elements toward the tape, and clamping the jaws of the endmost element on the tape to secure the element to the tape.

3. In the manufacture of slide fasteners, the method which includes providing a wire having a series of interlocking means therealong, severing the end of the wire in such configuration as to form a fastener element having a head including the interlocking means and having spread jaws, the head being of such dimension as to fit between the jaws of the next element, restoring the jaws at the end of the wire and severed element together again in nested relation, the configuration of the head and jaws being such as to interlock the head and jaws of the nested elements against separation longitudinally of the wire, moving the interlocked severed elements toward a tape, and clamping the jaws of the endmost element on the tape to secure the element to the tape.

4. In the manufacture of slide fasteners, the method which includes providing a wire having a series of interlocking means therealong, the width of the wire equalling that of the desired fastener elements with spread jaws, severing the end of the wire entirely across the wire in such configuration as to form a fastener element having a head including the interlocking means and having spread jaws, the head being of such dimension as to fully occupy the space between the jaws of the next element, restoring the jaws at the end of the wire and severed element together again in fully nested relation, moving the nested severed elements toward a tape, finishing the shaping of the nested severed elements before they reach the tape, and clamping the jaws of the endmost element on the tape to secure the element to the tape.

5. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire toward a moving tape and clamping plates, said wire having a width just equal to that of the desired fastener elements with spread jaws, a stationary die, a mating punch movable transversely of the wire to sever the wire from a piece of the wire projecting beyond the punch and overlying the die, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and a spring pad beneath the punch to restore the wire to the initial raised position.

6. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire toward a moving tape and clamping plates, said wire having a width just equal to that of the desired fastener elements with spread jaws, punch and die mechanism to sever the wire all the way across into fastener elements each having a head with spread jaws projecting forwardly therefrom, the punch being spaced from the tape an amount such that a number of severed elements lie on the die between the punch and the tape, and fixed guides on the die at each side of said elements to hold the same in alinement, the aforesaid punch and die mechanism being so shaped as to form fastener elements the head end of which is dimensioned to be received in and to fully occupy the jaw end of the next element, thereby avoiding waste of metal and preventing improper orientation of the elements in the aforesaid guides.

7. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire toward a moving tape and clamping plates, said wire having a width just equal to that of the desired fastener elements with spread jaws, and having closely spaced interlocking means therealong, a die and a punch movable transversely of the wire to sever the wire all the way across from a piece of the wire projecting beyond the punch and overlying the die, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and a spring pad beneath the punch to restore the wire to the element previously severed therefrom, the punch being spaced from the tape an amount such that a series of severed elements nested together with the head of each filling the jaw space of the next lie on the die between the punch and the tape.

8. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire having closely spaced projections therealong, a punch movable transversely of the wire to bear against and sever the wire from a small piece of the wire projecting beyond the punch, a locating pad yieldably movable with the punch to hold the projecting piece, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, the lower end of the locating pad being so formed as to mate with the projection on the element in order to properly locate the periphery of the element relative to the projection thereon.

9. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a tape, means to intermittently feed toward the tape a wire having closely spaced interlocking means therealong, a punch movable transversely of the wire to sever therefrom a fastener element having a head with spread jaws projecting forwardly therefrom, a cam for reciprocating the punch, a rocker arm between the cam and punch, a counter, and means responsive to the counter for locking the rocker arm in outermost position at the cam and thereby interrupting the supply of severed elements to the tape without interrupting feed of the tape.

10. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed toward a tape a wire having closely spaced interlocking means therealong, a punch movable transversely of the wire to sever a piece of the wire, the outline of the punch being such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the severed parts, the punch being spaced from the tape an amount such that a series of severed elements nested together with the head of each filling the jaw space of the next lie between the punch and the tape, and finishing means located between the severing punch and the tape, said finishing means functioning to

smooth a part of an element between the severing punch and the tape.

11. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed toward a tape a wire having closely spaced interlocking means therealong, a punch movable transversely of the wire to sever the wire from a piece of the wire projecting beyond the punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the element previously severed therefrom, the punch being spaced from the tape an amount such that a series of severed elements nested together with the head of each filling the jaw space of the next lie between the punch and the tape, and a rounding punch associated with said severing punch and located between the severing punch and the tape, said rounding punch functioning to round the lower peripheral edge of the head of an element between the severing punch and the tape.

12. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire having a series of projections therealong, said wire feed means comprising a reciprocating dog for engaging a projection on the wire and feeding the wire during its forward movement, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the aforesaid severed piece constitutes a fastener element, and a spring pad beneath the punch, the timing of the machine being such that the wire is held downwardly by the punch during retraction of the feed dog and is held upwardly by the spring pad during forward movement of the feed dog.

13. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire having closely spaced interlocking means therealong, said wire feed means comprising a feed cam and a feed dog reciprocated thereby for engaging and feeding the wire during its forward movement, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the initial raised position, and a punch operating cam, the timing of the cams of the machine being such that the wire is held downwardly by the punch during retraction of the feed dog, and is held upwardly by the spring pad during the forward movement of the feed dog.

14. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire, said wire feed means comprising a reciprocating feed dog for engaging a projection on the wire and feeding the wire during its forward movement, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the severed piece constitutes a fastener element, a spring pad beneath the punch, the timing of the machine being such that the wire is held downwardly by the punch during retraction of the feed dog and is held upwardly by the spring pad during forward movement of the feed dog, a counter, and means responsive to the counter to lock the punch in down position, thus holding the wire downwardly out of engagement with the reciprocating feed dog.

15. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire having closely spaced interlocking means therealong, said wire feed means comprising a feed cam and feed dog reciprocated thereby for engaging and feeding the wire during its forward movement, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the initial raised position, a punch operating cam, a rocker between the cam and the punch, the timing of the machine being such that the wire is held downwardly by the punch during retraction of the feed dog and is held upwardly by the spring pad during forward movement of the feed dog, a counter, and means responsive to the counter to lock the rocker in outermost position with the punch in down position, thus holding the wire downwardly out of engagement with the reciprocating feed dog.

16. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire, a punch movable transversely of the wire to sever the wire downwardly from a fastener element projecting beyond the punch, a spring pad beneath the punch, and pointed stationary die surfaces beneath the wire at opposite sides of the spring pad cooperating with mating recesses on the sides of the punch for removing triangular shaped pieces of scrap metal on opposite sides of the wire.

17. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire toward a tape, said wire having a series of interlocking means therealong, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the initial raised position, and stationary die surfaces beneath the wire at opposite sides of the spring pad for removing triangular shaped pieces of scrap metal on opposite sides of the wire.

18. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire, punch and die means to so cut the wire as to form fastener elements therefrom and also small pieces of scrap which remain on the die as the punch descends, and means to feed a blast of air continuously at the side of the punch and thence over the top of the die mechanism in order to blow the pieces of scrap outwardly therefrom.

19. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire, said wire having in-

terlocking means thereon, punch and die mechanism to sever the wire, the outline of the punch being such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, additional punch and die surfaces for removing a triangular-shaped piece of scrap metal at the outside of the jaws, which pieces remain on the die as the punch descends, and air blast means for helping transfer the small triangular pieces of scrap to an appropriate receptacle including nozzles to blow air at the sides of the punch and thence outwardly over the top of the die.

20. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed toward a tape a wire having serrated side edges, the serrations of which carry a comparatively thin fin, said wire also having a series of interlocking means, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the initial raised position, and stationary die surfaces beneath the wire at opposite sides of the spring pad for removing the triangular shaped fins or scrap metal on opposite sides of the wire.

21. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed toward a tape a wire having serrated side edges, the serrations of which carry a comparatively thin fin, said wire also having a series of interlocking means, a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the initial raised position, stationary die surfaces beneath the wire at opposite sides of the spring pad for removing the triangular shaped fins or scrap metal on opposite sides of the wire, and air blast means for helping remove the small triangular pieces of fin or scrap left on top of said stationary die surfaces, said means including conduits to guide the compressed air to a point above the pieces of scrap at opposite sides of the punch, and to then guide the air and scrap metal away from the punch to an appropriate receptacle.

22. In the manufacture of slide fastener elements comprising a head and spread jaws connected thereto, said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough to receive the entire head of an identical element, and said jaws being so shaped that when closed the outer edges come into substantially parallel relationship and having approximately perpendicular ends, the method which includes punching away small triangular pieces of scrap or waste at the side edges of a strip in order to give the strip notched or serrated side edges conforming to the square outer ends of spread jaws having the desired shape, the notches or serrations being so closely spaced as to correspond to a series of embryo elements with spread jaws if the head of one element is nested fully within and substantially fills the space within the spread jaws of the next element, and severing the strip on an outline corresponding to the outline of the head and intersecting the inner angle of the triangular notches at the sides of the strip, in order to define elements of the desired shape without scrap or waste other than the aforesaid triangular pieces of scrap.

23. In the manufacture of slide fasteners, the method which includes severing the end of a wire in such configuration as to form a fastener element having a head and spread jaws, the head being of such dimension as to fit between the jaws of the next element, restoring the jaws at the end of the wire and severed element together again in nested relation, the configuration of the head and jaws being such as to interlock the head and jaws against separation longitudinally of the wire, moving the interlocked severed elements toward a tape, and clamping the jaws of the endmost element on the tape to secure the element thereto.

24. Apparatus for the manufacture of slide fastener elements comprising a head and spread jaws connected thereto, said jaws being so widely spaced and spread and so shaped as to form a space therebetween large enough to receive the entire head of an identical element, and said jaws being so shaped that when closed, the outer edges come into substantially parallel relationship, said apparatus comprising means to intermittently feed a wire having the width of the elements with spread jaws, and a single punch and die mechanism, a portion of said punch and die being so shaped as to cut small, triangular pieces of scrap from the side edges of the wire at the end of the wire in order to give the wire notched or serrated side edges conforming to the outer ends of spread jaws having the desired shape, another portion of said punch and die mechanism operating to cut the wire or strip on a line corresponding to the outline of the head and intersecting the inner angle of the triangular notches at the sides of the strip, whereby elements of the desired shape are cut from the wire without waste other than the aforesaid triangular pieces of scrap.

25. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a tape upwardly, means to intermittently horizontally feed toward the tape a wire having closely spaced projections therealong, said wire feed means including a horizontally reciprocating feed dog for engaging a projection on the wire and thereby feeding the wire, a stationary die and a punch movable downwardly to sever the wire downwardly from a piece of the wire projecting beyond the punch and overlying the stationary die, the outline of the punch and mating die being such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, a cam and cam follower for reciprocating the punch, a counter, and means responsive to the counter for locking the cam follower in outermost position and thereby interrupting reciprocation of the punch with the punch and wire in down position, and consequently interrupting the supply of severed elements to the tape, without, however, interrupting feed of the tape.

26. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to

intermittently feed a wire toward a tape, said wire having a series of interlocking means thereon, a stationary die and a punch movable transversely of the wire to sever the wire downwardly from a piece of the wire projecting beyond the punch and overlying the die, the outline of the punch and mating die being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the initial raised position, stationary die surfaces beneath the wire at opposite sides of the spring pad cooperating with mating channels on the sides of the punch for removing triangular shaped pieces of scrap on opposite sides of the wire, and air-blast means for helping remove the triangular pieces of scrap left on top of said stationary die surfaces, said means causing a flow of air from the sides of the punch outwardly over the top of the die.

27. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a wire having a width equal to the width of an element with spread jaws, a punch and die operating to sever the wire, said die having a generally key-hole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion, said pad lifting the wire clear of the die for forward feed, said punch having a concave side mating with the aforesaid convex die portion, the arrangement being such that, when the punch descends, it severs the wire downwardly from an element supported on the stationary die portion at the end of the wire, the outline of the punch and die being such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fully occupy the space between the jaws without scrap or waste, wire feed means to intermittently feed the wire to the punch and die, each of the repeated feed distances equalling only a small fraction of the length of an element, tape feed means to intermittently feed the tape upwardly, clamping plates closely overlying the die to clamp a severed element on the beaded edge of the tape, and cam means to operate said wire feed means and tape feed means and clamping plates in proper timing.

28. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides, said apparatus comprising means to guide a wire, a punch and die functioning to cut small, triangular pieces of scrap to give the jaws the desired perpendicular ends, and further functioning to sever the wire, said die having a generally key-hole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising two pointed or triangular-shaped pieces for cutting triangular notches in the side edges of the wire, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion and triangular cutting portions, said pad lifting the wire clear of the die for forward feed, said punch having a concave side mating with the aforesaid convex die portion, said punch further having triangularly grooved channels in the sides mating with the aforesaid triangular die portions, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, and further severs the wire from two triangular pieces of scrap supported on the aforesaid triangular die portions, the element and scrap being left stationary on the die while the wire is punched downwardly away from the same, the outline of the punch and die being such that the severed piece constitutes a fastener element.

29. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides, said apparatus comprising means to guide a wire, punch and die mechanism functioning to cut small triangular shaped pieces of metal from the side of the wire, and further functioning to sever the wire, said die having a generally key-hole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising two pointed or triangular shaped side pieces for cutting notches in the side edges of the wire, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion and triangular cutting portions, said pad lifting the wire clear of the die for forward feed, said punch having a concave side mating with the aforesaid convex die portion, said punch further having triangularly grooved channels in the sides mating with the aforesaid triangular portions, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, and further severs the wire from two triangular pieces of scrap supported on the aforesaid triangular die portions, the element and scrap being left stationary on the die while the wire is punched downwardly away from the same, the outline of the severing punch being such that the severed piece constitutes a fastener element having a head with spread jaws, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, air-flow means for moving said small triangular pieces of scrap outwardly from the triangular die portions, and feed means to intermittently feed the wire to the punch and die, each of the repeated feed distances equalling only a small fraction of the length of an element.

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DEFENDANT'S EXHIBIT "BI"

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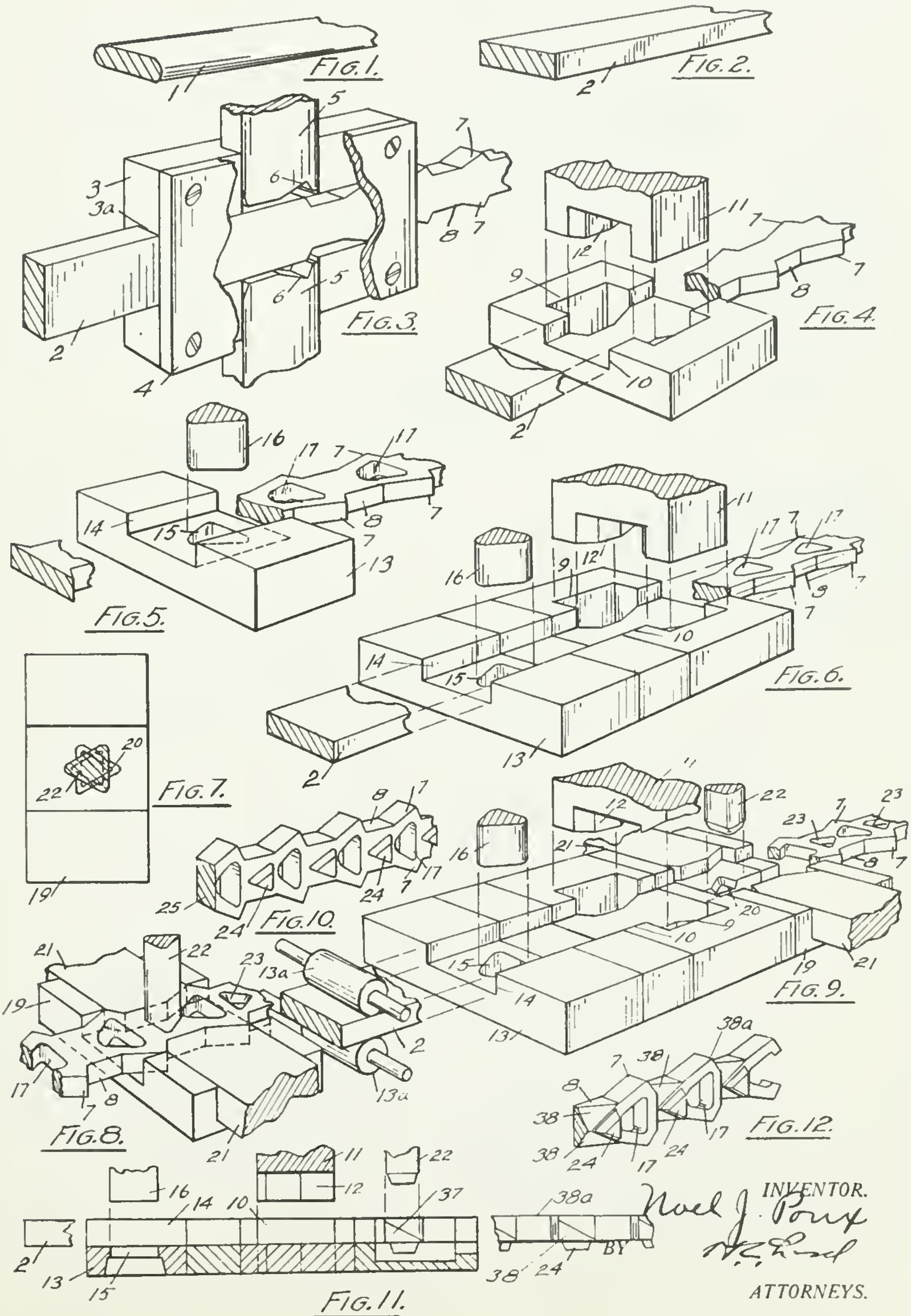
Filed Dec. 16, 1933 Patented Aug. 8, 1939

Aug. 8, 1939 N. J. POUX 2,169,176

METHOD OF MAKING SEPARABLE FASTENERS

Original Filed Dec. 16, 1933 7 Sheets-Sheet 1



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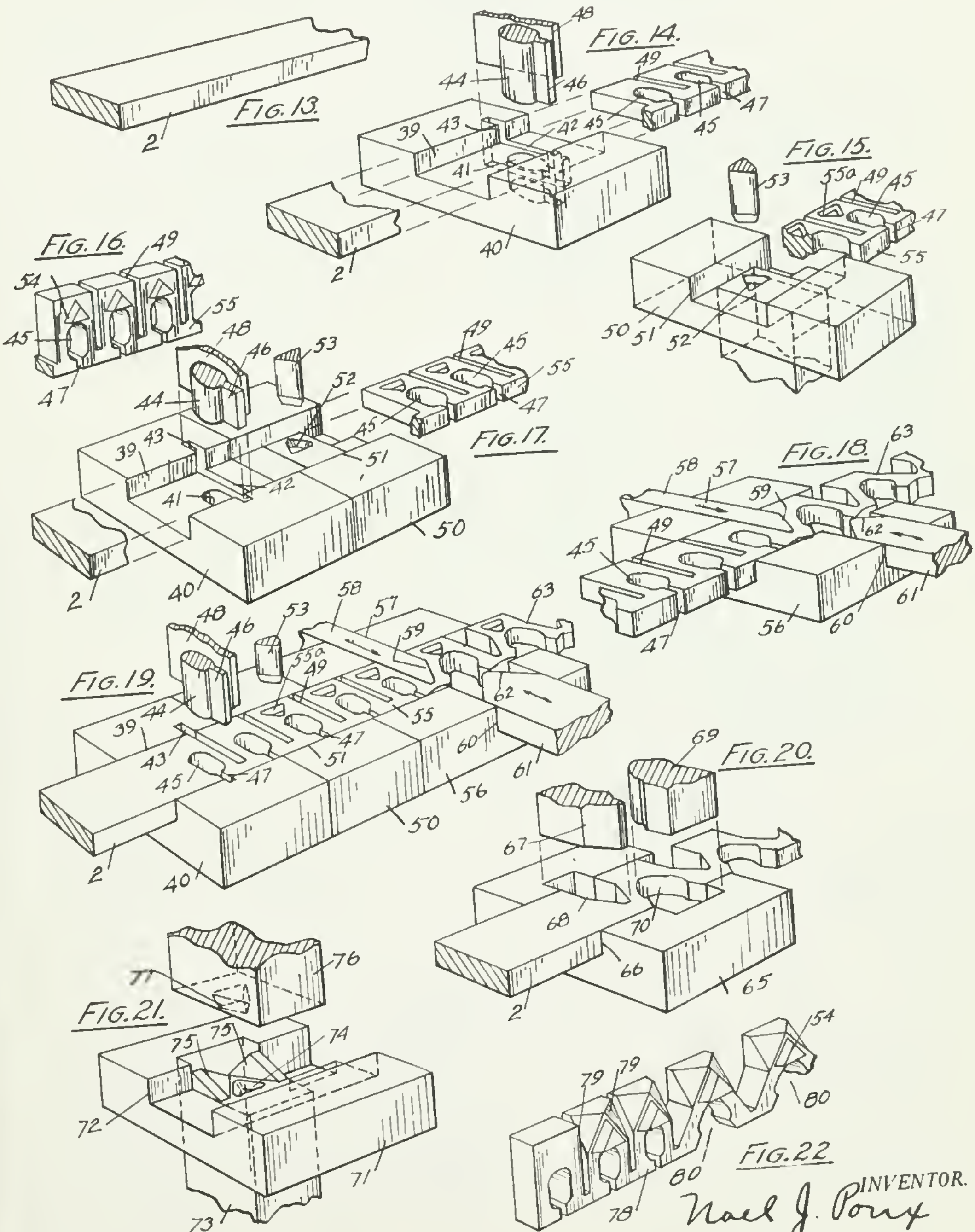
Aug. 8, 1939 N. J. POUX 2,169,176

METHOD OF MAKING SEPARABLE FASTENERS

Original Filed Dec. 16, 1933 7 Sheets-Sheet 2



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METHOD OF MAKING SEPARABLE FASTENERS

Original Filed Dec. 16, 1933 7 Sheets-Sheet 3

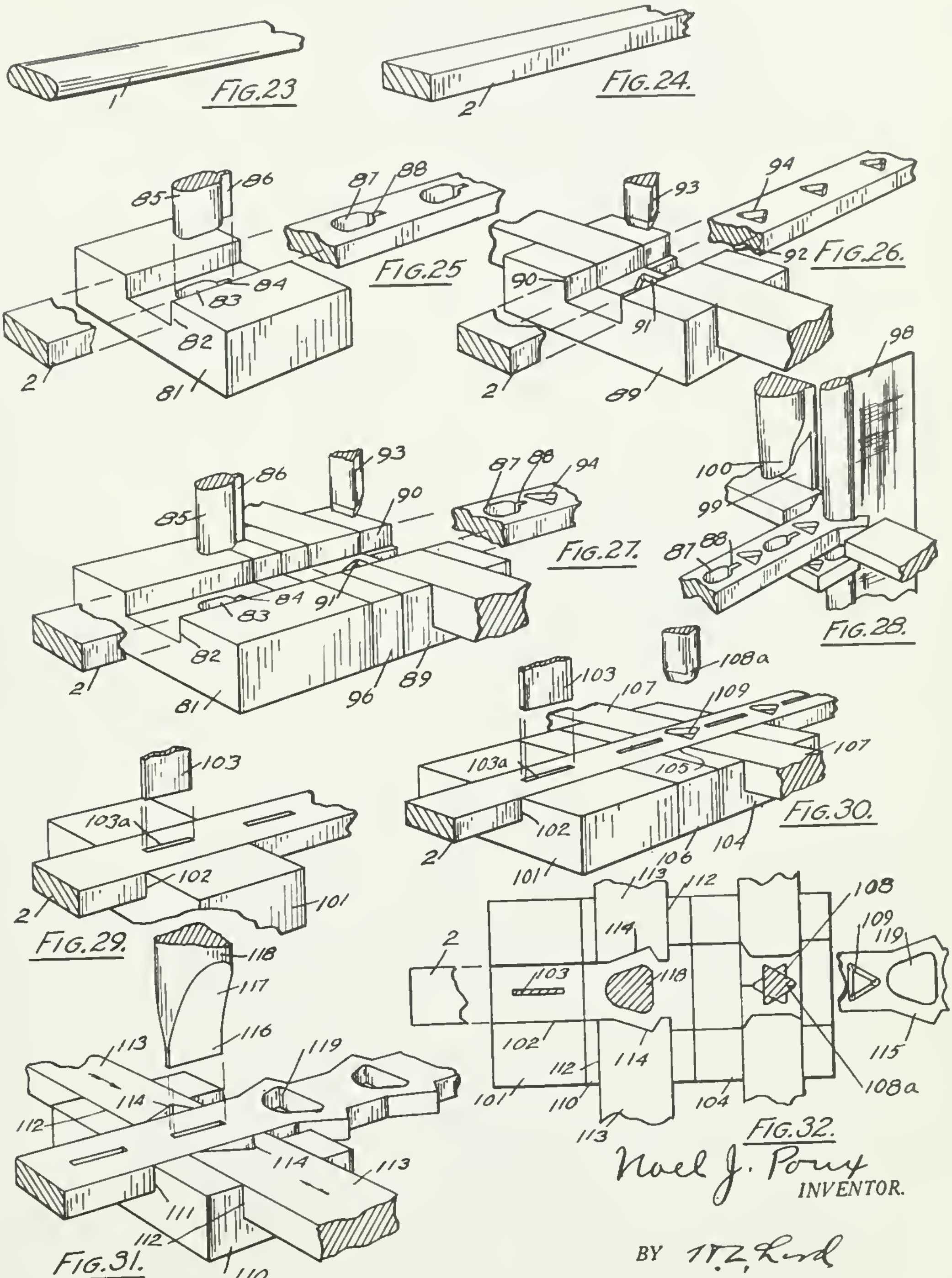

FIG. 23 FIG. 24. FIG. 25 FIG. 26. FIG. 27. FIG. 28. FIG. 29. FIG. 30. FIG. 31. FIG. 32.

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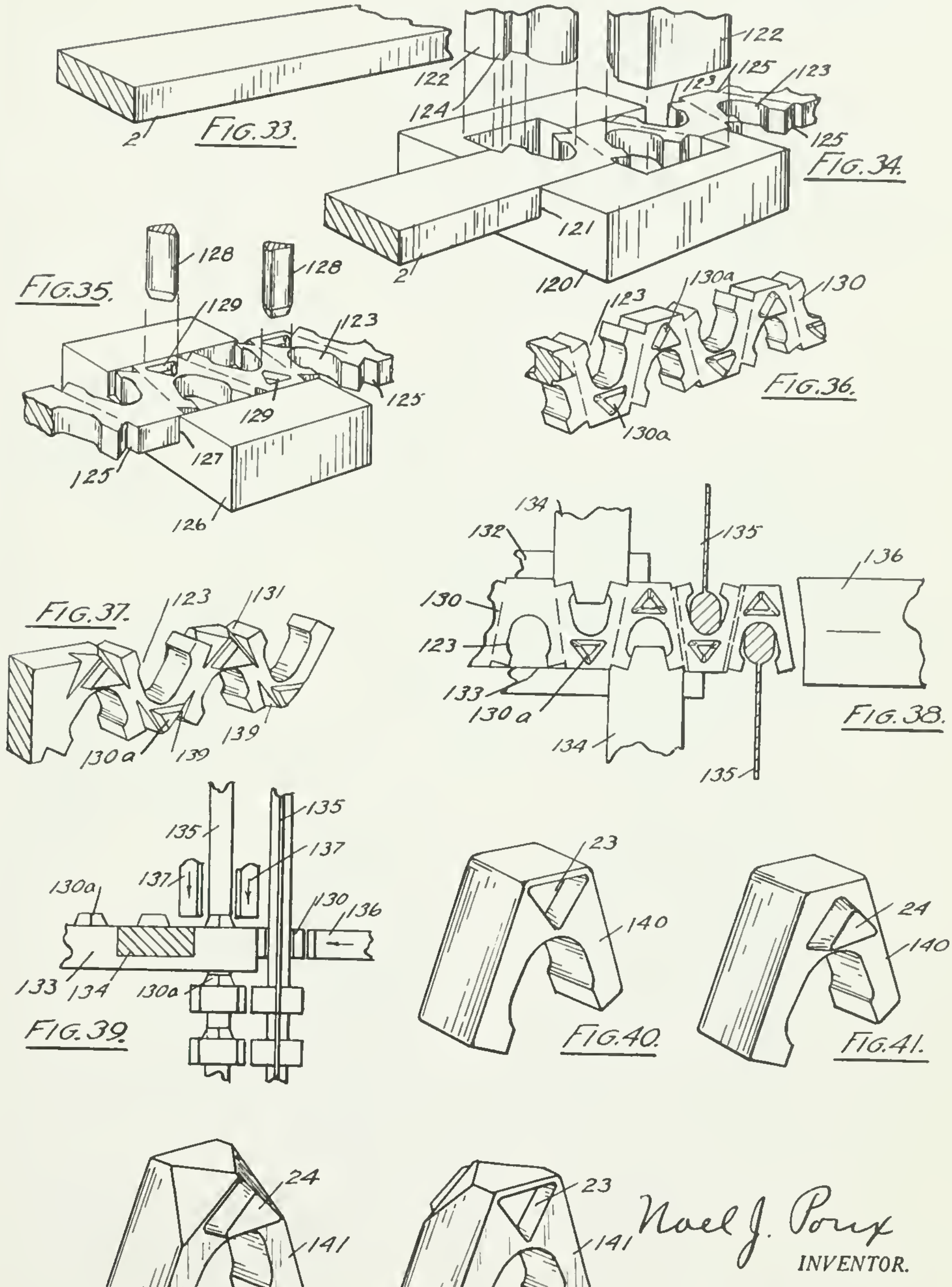

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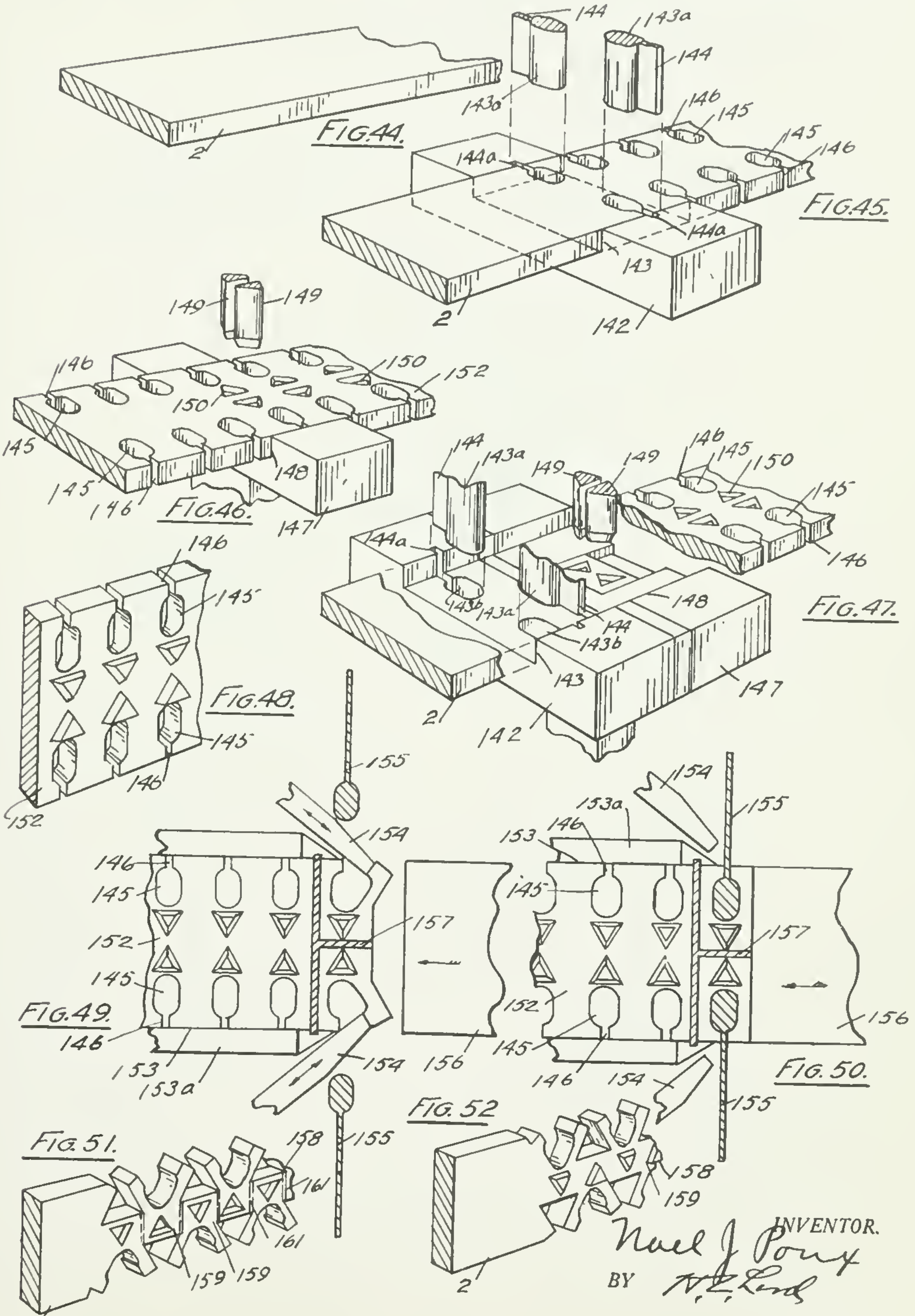
METHOD OF MAKING SEPARABLE FASTENERS

Original Filed Dec. 16, 1933

7 Sheets-Sheet 5



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Original Filed Dec. 16, 1933 7 Sheets-Sheet 6

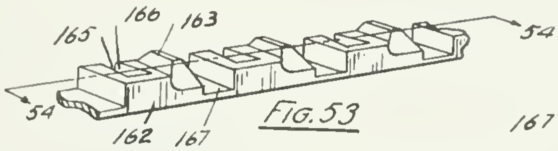

FIG. 53

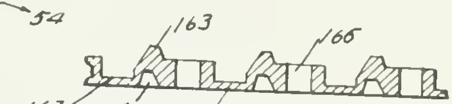

FIG. 54.

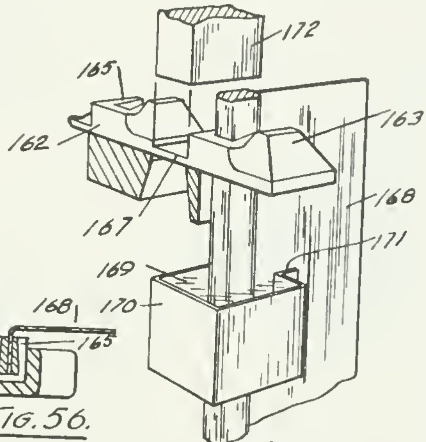

FIG. 55

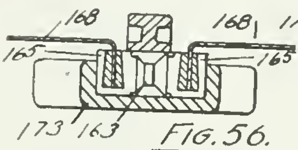

FIG. 56.

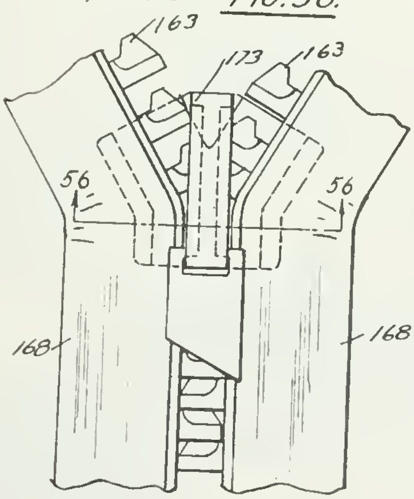

FIG. 57.

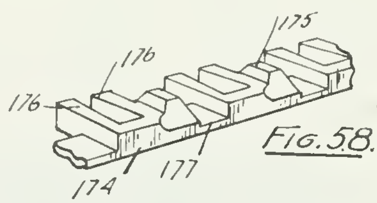

FIG. 58.

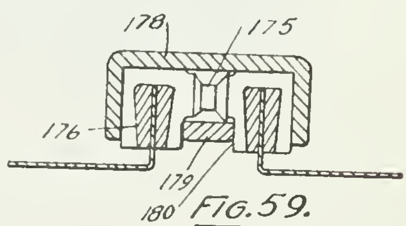

FIG. 59.

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METHOD OF MAKING SEPARABLE FASTENERS

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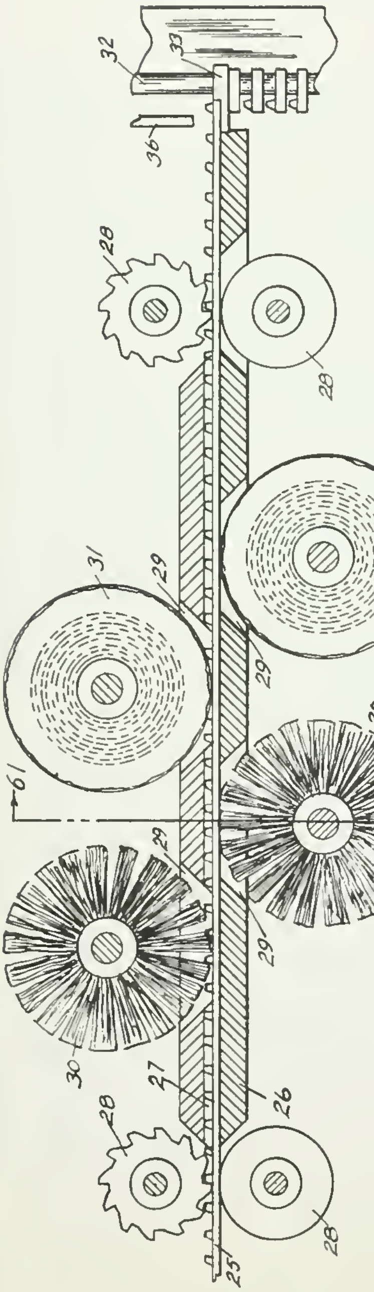

FIG. 60.

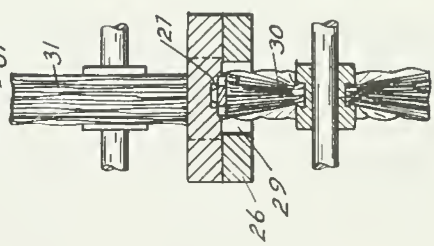

FIG. 61.

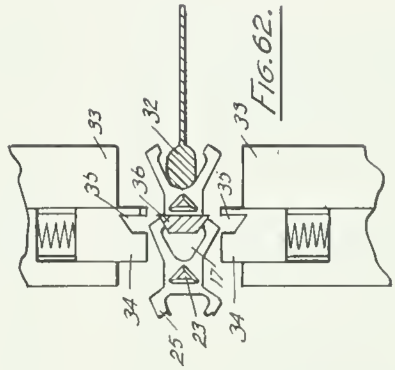

FIG. 62.

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UNITED STATES PATENT OFFICE

2,169,176

METHOD OF MAKING SEPARABLE FASTENERS

Noel Joseph Poux, Meadville, Pa., assignor to Talon, Inc., Meadville, Pa., a corporation of Pennsylvania

Application December 16, 1933, Serial No. 702,766
Renewed February 10, 1939

21 Claims. (Cl. 29—148)

This invention relates to separable fasteners of the zipper type and particularly to methods of making the interlocking elements and attaching them to the tapes.

It is among the objects of the invention to provide simple and inexpensive processes of forming interlocking elements and attaching them to the tapes, particularly to provide an improved process of manufacture in which a series of interlocking elements is formed as a continuous strip, to minimize and reduce the amount of scrap, and to provide an improved method in which the interlocking elements may be smoothed or otherwise processed during their manufacture.

Other objects and advantages of the invention will be apparent from the following description and accompanying drawings.

In the manufacture of separable fasteners one of the problems encountered is the forming and making of the individual interlocking members in a manner that permits of their simple and easy fabrication, and a convenient manner and apparatus for polishing and finishing the surfaces of the members and attaching the same to the tape. In the present invention I accomplish this by a very effective method and with simple apparatus by forming the individual members practically complete in a continuous strip of metal, or material from which the members are made without severing one member from another. In this way it is possible to form the members rapidly, to hold them after such formation in considerable quantities and in small space, if desired, run the strips in which the members are formed through such cleaning and polishing operations as may be desirable and then attach them to the tape and sever them from the strip. This general plan may be practiced in numerous ways. The individual members may be formed by coining, or stamping, and may be arranged in their formation lengthwise of the strip, crosswise of the strip, or in double rows. The jaws may be stamped to their open position from metal of sufficient area to supply the material, or they may be stamped, or formed with jaws in substantially closed position and forced open. These and other features and details of the invention will appear more fully from the specification and claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings as follows:—

Fig. 1 shows a perspective view of a metal bar, or strip, having rounded corners from which the members may be fabricated.

Fig. 2 a similar strip having square corners.

Fig. 3 a perspective view of a strip coining or forging die coining the edges of the strip.

Fig. 4 a perspective view of a stamping or cutting die stamping the exterior edges of a strip.

Fig. 5 a perspective view of a die for punching the material from between the jaws.

Fig. 6 a stamp combining the dies of Figs. 4 and 5.

Fig. 7 a plan of a punch and die forming the recess and projection of the interlocking element.

Fig. 8 a perspective view of the die and punch forming the projection and recess.

Fig. 9 a press combining the dies of Figs. 6 and 8.

Fig. 10 a perspective view of a finished strip showing the projection side, the recess side being shown at the end of Fig. 9.

Fig. 11 shows a sectional view of the die adapted to form inclines on the members at the sides of the projections.

Fig. 12 a perspective view of a strip having the inclined sides.

In the strip so far made the members are arranged end to end and the jaws are formed initially in an open position.

Figs. 13 to 22 illustrate apparatus and means for forming the strips with the members crosswise thereof.

Fig. 13 is a perspective view of the strip blank.

Fig. 14 a perspective view of a punch press for punching the jaw slots and separating slots for the members.

Fig. 15 a perspective view of a press for forming the recesses and projections on the strip.

Fig. 16 a view indicating the completed strip as it comes from the press shown in Fig. 15.

Fig. 17 shows the press with the dies of Figs. 14 and 15 combined.

Fig. 18 a manner of spreading the jaws from a strip as it comes from the dies of Fig. 14.

Fig. 19 a similar apparatus for spreading the jaws from a strip as it comes from the dies shown in Fig. 15.

Fig. 20 illustrates a press in which the jaws and separating slots are formed in their open position.

Fig. 21 a perspective view of a die for forming the inclined sides on the members of a strip.

Fig. 22 a strip showing the inclined sides formed thereon and the formation of the jaws as they are spread.

In the method and apparatus illustrated in Figs. 23 to 32 inclusive the members are arranged end to end in the strip, but the jaws are formed initially close together and spread.

Figs. 23 and 24 show perspective views of the blank strips.

Fig. 25 a press for forming jaw slots in the strip.

Fig. 26 a press for forming the projections and recesses in the strip.

Fig. 27 the presses of Figs. 25 and 26 combined.

Fig. 28 an apparatus for spreading the jaws of a formed member, attaching the member to a tape, and cutting the attached member from the strip.

Fig. 29 a press making the first step in an alternative method forming an initial slit.

Fig. 30 a press having dies forming a recess and projection, these dies being combined with the dies of Fig. 29.

Fig. 31 a perspective view of the dies for spreading the jaws.

Fig. 32 the dies of Figs. 30 and 31 combined.

In the apparatus and method and strip shown in Figs. 33 to 39 strips with crosswise members are shown and the method of forming the same.

Fig. 33 shows a perspective view of the blank.

Fig. 34 dies cutting jaw slots in each edge of the strip.

Fig. 35 dies forming recesses and projections at opposite edges.

Fig. 36 a perspective view of the strip as it comes from the dies in Fig. 35.

Fig. 37 a perspective view of a strip having the incline added thereto.

Fig. 38 a plan view of the part of the apparatus for attaching the strip to a tape.

Fig. 39 an elevation of the same.

Figs. 40 and 41 perspective views of the finished members with straight sides.

Figs. 42 and 43 perspective views of the members with inclined sides.

The apparatus and methods shown in Figs. 44 to 52 illustrate a manner of forming strips with the members arranged crosswise of the strip and projecting from opposite sides thereof.

Fig. 44 shows a perspective view of the blank.

Fig. 45 dies for punching the jaw slots.

Fig. 46 a press for forming the projections and recesses.

Fig. 47 a combined press having the dies of Figs. 43 and 44 combined.

Fig. 48 a perspective view of the completed strip.

Fig. 49 a plan view showing a method of opening the jaws for receiving a tape.

Fig. 50 a plan view showing the method with the jaws closed on the tape and ready to be severed.

Figs. 51 and 52 alternative constructions of strips.

Fig. 53 shows a perspective view of a strip for making an alternative form of fastener.

Fig. 54 a central section of the same on the line 54—54 in Fig. 53.

Fig. 55 shows a perspective view of the apparatus for attaching the same to a tape.

Fig. 56 a sectional view of the completed fastener and slider.

Fig. 57 a plan view of the slider on the fastener.

Fig. 58 an alternative form of strip.

Fig. 59 a sectional view through the slider of the fastener formed from the strip of Fig. 58.

Fig. 60 shows a device for polishing and assembling fasteners.

Fig. 61 a section on line 61—61 Fig. 60.

Fig. 62 a plan view of jaw closing devices.

It will be noted that through the several figures dies are formed for individual operations and are ganged for progressively forming operations. These arrangements are made readily possible in that the strips are retained intact so that they can readily be run through separate machines, or machines that perform the several operations in one machine.

1 marks the strip blank with rounded edges, and 2 a strip blank having straight edges. In the structure shown in Fig. 3, 3 marks the die. This has a strip guide 3a and a cover plate 4. Side dies 5 are brought into clamping engagement with the edges of the strip by any convenient mechanism (not shown) and these are provided with recesses 6 into which the material may be forced outlining the outer edges of the spread jaws of a member.

The strip may be formed with this relation of edges by stamping, as illustrated in Fig. 4, the die 9 having a strip guide 10, a punch 11 having die faces 12 adapted to cut out the part between the jaw incline 7 forming the interlocking part 8 of the members.

The strip formed in either of the manners described may have the jaw slots punched, as shown in Fig. 5. A die 13 has a strip guide 14. The base of the guide has a cutting opening 15 and a punch 16 operates over the die to cut jaw slots 17.

The dies 9 and 13 may be arranged in tandem so that the slots 17 and edge formation may be accomplished in one operation.

The recesses and projections are formed in the faces of the strips and this may be accomplished as indicated in Fig. 8. A die block 19 has a strip slot 19a in the bottom of which is a recess 20 for forming a projection 24. Side dies 21 engage the side edges of the strip and a punch 22 forms a recess 23 in the strip.

In Fig. 9 the die 19 is associated with the die blocks 9 and 13 so that the three operations may be accomplished in one pass of the strip. Feeding rolls 13a are arranged to advance the strip through the dies and these may be provided with any well-known control mechanism to advance the strip in proper timing. It will be understood that with each of the die grooves in which the strips are advanced a similar set of feeding rolls is ordinarily to be provided.

The completed strip having the edges and jaw slots and projections and recesses formed thereon and therein is illustrated in Fig. 10. This strip may be readily processed and attached to a tape, as indicated in Fig. 60.

A guide table 26 has a guide slot 27 for feeding the strip 25. Rolls 28 are arranged at each end of the table for accomplishing a definite forward feed, the upper feed rolls 28 being notched to engage the projections. The table 26 has openings 29 above and below at intervals leading to the guide slot 27 and wire brushes 30 operate in these openings on the strip as it passes out. Buffers 31 operate through succeeding openings so that the strip may be readily processed as it advances. The strip after this polishing operation may be again rolled and stored, or it may be directly attached to the tape 32 from this operation. The end of the strip with its jaws carried straddle the tape is closed by pressure fingers 33. As the pressure fingers close die plates 34 are carried under the strip between the first and last members and these dies have die slots 35. A cutter 36 severs the last member from the strip, the cutter operating in connection with the slots 36. In some constructions it is desirable to incline the front corners of the members and this is accomplished by arranging an inclined die face 37 on the side die members 21 (see Fig. 11). This provides the inclines 38 as shown in the strip 38a (Fig. 12).

In forming the strips with the members crosswise (Fig. 13 and immediately following) the strip blank 2 is fed into a guide groove 39 of the die block 40. This die block has a die opening 41 and slots 42 and 43 which operate with a punch 44 for forming a jaw slot 45, and an extension 46 on the punch for forming a slot extension 47 of the die slot. There is provided a separation punch 48 for cutting a separation slot 49 which nearly severs the strip between a member. The strip may then be run through the dies shown in Fig. 15 having a die block 50 and a feed groove 51. The dies have a recess 52, a punch 53 for forming a projection 54 and recess 55a respectively forming as it comes from the dies a strip 55. If desired the die blocks 40 and 50 may be placed in tandem, as shown in Fig. 17, and the strip formed in one continuous operation. The completed strip, is shown in perspective in Fig. 16. The completed strip is run through die blocks 56. This die block has a transverse guide groove 57 in which a spreader punch 58 operates. The spreader punch has a cam surface 59 corresponding to the desired outer slant of the member jaw with the jaw in open condition. An opposite transverse guide slot 60 is also provided in the block 56 and this has a spreader punch 61 with a cam surface 62. As the strip is advanced, the punch 58 advances and spreads one side of the jaw of a member and while the member is held by the punch 58 the punch 61 advances and spreads the opposite jaw, thus forming an ultimate strip 63 with the jaws spread. If desired the die 56 may be arranged in tandem and with the die blocks 40 and 50 and the whole operation is completed in one progressive operation. The strip may be formed by a stamping operation in which the jaws are formed initially in spread position and such a manner of forming is indicated in Fig. 20. A die block 65 has a die groove 66. Punches 67 form slots 68 between the members and punches 69 a jaw slot 70. It may be desirable also to provide the front corners of the members with inclined surfaces and this is accomplished in the die scheme shown in Fig. 21 wherein a die block 71 has a die groove 72. A punch 73 is arranged through the bottom of the block 71 and in the face of the punch 73 there is provided a recess 74 for forming the projection 54 on the member and there are also formed on the face of the punch inclined surfaces 75. A punch 76 has a flat face of sufficient area to force the portion of the strip containing the member into coining relation to the inclined surfaces and recess. At the same time the punch 76 is provided with recess forming projections 77. Thus the strip 78 as it comes from the die 71 has inclined ends 79. The die block 71 may be substituted for the die block 60 in the die arrangements of Figs. 17 and 19 and consequently form a strip with jaw slots 80 open, as shown in Fig. 22.

The strips and apparatus for forming the same shown in Figs. 23 and following use the same bar blanks 1, or 2, as in the preceding structures. A die block 81 (Fig. 25) has a guide groove 82 through which the strip is fed and this has a jaw slot opening 83 with an extension 84 adapted to operate with a punch 85 and its extension 86 forming in the strip a jaw slot 87 with its separating extension 88. The strip so formed may be fed through a die block 89, the die block having a die groove 90 in the bottom of which is formed a recess 91 for forming a member projection 92. A punch 93 operates on the strip to form a recess 94. The die blocks 81 and 89 may be associated, as shown in Fig. 21, with a spacer block 96 between them in which event these operations may be performed progressively. This strip is presented with its forward end to a tape 98. The end member has its jaws closed on the tape by punches, such as 33, shown in Fig. 55. The member is severed by a cutter 99 corresponding to the cutter 36. Arranged on the cutter 99 is a jaw opening 100 which with the continued advance of the cutter 99 spreads the jaws of the next to the last member so as to prepare the jaws to receive the tape.

This manner of forming the members without great waste of material may be accomplished also in the manner illustrated in Figs. 29 and immediately following. In Fig. 29 a die block 101 has a die groove 102. A punch 103 forms longitudinal slots 103a. The strip is carried through a die block 104 having a die groove 105. This may be associated with the die block 101 properly spaced by spacers 106. Side punches 107 are arranged in the die block 104 to properly hold the strip as the member projections and recesses are formed, the projection being formed in the recesses 108 by a punch 109a. The strip may be run through a block 110 with a die groove 111. Side punches 113 operate in transverse grooves 112. These side punches have recesses 114 adapted to receive metal forming the outer edge of the jaws. A punch 116 is shaped to enter the slot 103. The punch has an inclined spreading surface 117 terminating in a cross sectional shape 118 desired for the jaw slot 119. This jaw spreading may take place, if desired, before or after, the forming of the projections and recesses.

In Fig. 32 the dies using the block 101, the block 110 and the block 104 are associated so that the strip 115 as a whole may be fabricated in one progressive operation.

In Figs. 33 to 38 a desirable method of forming interlocking members in strips is shown. A guide block 120 has a die groove 121 receiving the strip blank 2. Punches 122 form oppositely placed and staggered jaw slots 123 in the strip. The edge of the strip is notched by a projection 124 on the punch at 125 to form the outer edges of the jaws. A die block 126 has a die guide 127 (see Fig. 35) through which the strip coming from the block 120 is passed and punches 128 operate on the strip to form recesses 129 and the opposite projections 130a in the manner of the preceding operations. The blocks 120 and 126 may be placed in tandem, if desired.

A finished strip 130 may be attached to a tape in the manner indicated in Figs. 38 and 39. A guide block 132 has a guide groove 133 and a clamping plunger 134 engages the strip intermittently as it is fed forward. Tapes 135 are placed in the jaw slots of the two end members. A punch 136 engages the end of the strip and closes the jaws of the two members. Cutters 137 sever the members so attached to the tape on the lines 138. If desired, the strip may have inclined front corners formed in it at 139 by coining, or otherwise, as desired.

In Figs. 40 and 41 individual interlocking members 140 are shown having the recesses 23 and projections 24, these members being without the inclined front corners and in Figs. 42 and 43 individual interlocking members 141 are shown in which the front corners are inclined.

In Figs. 44 and following is shown an alternative apparatus and method for forming and attaching members from the strips. In this as in the others the strip blank 2 is used. A die block 142 has a die groove 143 through which the strip blank is fed. Punches 143a have punch extensions 144 forming jaw slots 145 with extensions 146 in the opposite sides of the strip and these are arranged directly opposite each other, the die block having openings 143b and 144a corresponding to the punch structure. The die block 147 has a die groove 148. Punches 149 form recesses 150 in the die groove forming the projections. The finished strip 152, therefore, has the interlocking projections and recesses and the jaw slots. If desired, the die blocks 142 and 147 may be set in tandem so that these operations may be performed in a continuous manner. The strip 152 is passed through a guide groove 153 in a guide block 153a and the jaws at the end of the strip are opened by punches 154. Tapes 155 are introduced into the slots and the jaws closed by a punch 156. As soon as the jaws are closed the end members are severed from each other and from the strip by a cutter 157.

In Figs. 51 and 52 an alternative form of strip 158 is shown. In this the interlocking portions of the members 159 have jaws 160 staggered and directed to opposite sides of the strip. The interlocking portions of the members 159 are in alinement at the center of the strip. The members are severed on the line 161.

In Figs. 53 to 59 are shown strips for interlocking members having jaws which may be attached by adhesion and for forming fasteners with the jaws extending toward one side or the other of the fastener instead of edgewise. In Fig. 53 a strip 162 is shown having projections 163 and recesses 164, these being of the common shape found in interlocking members of separable fasteners. The fastening jaws 165 provide a jaw slot 166 which extends edgewise instead of endwise of the member and crosswise instead of edgewise of the completed fastener. These strips have grooves 167, one wall of which forms the front wall of the final member and this forms a part of the strip which can be readily removed for separating the members. In attaching the members a tape 168 is drawn through a cementing material 169 carried by a receptacle 170, the tape itself sealing a slot 171 in the receptacle. The tape is introduced into the slot of the end member of the strip and the strip is severed by a punch 172 in the groove cutting out the bottom of the groove 167. The cementing material is of sufficient adhesiveness to secure the interlocking member. These interlocking members are operated in a slider 173 in the ordinary manner of interlocking members, the difference being that the slots open toward the same face of the fastener and the tape extends at right angles from the direction of the securing slot. This puts practically the whole fastener on one side of the tape and makes a comparatively smooth surface on the opposite side of the tape.

In Figs. 58 and 59 a slight variation of the strip and member is shown. A strip 174 has projections 175, these projections being of less width than the member. Jaws 176 extend edgewise of the member but are longer than the interlocking part of the member occupied by the projection. The strip is provided with grooves 177 for severing the strip. A slider 178 operating with the fastener of this type has one of its walls 179 arranged between the overlapping ends of the jaws in a groove 180 formed thereby. In this way the projection portions of the fastener from one face of the member are practically obviated.

In each of these methods it will be observed there is an enlongated strip of united members. This may be secured to the tape in a continuous process, or each of the steps may be readily performed independently as the strips may be readily rolled. The strips while the members are still united may be thoroughly processed, polished and finished, the only final action being the severing of the members and attachment to the tape.

What I claim as new is:

1. The method of forming interlocking members for separable fasteners which consists in shaping the said members while united in a strip, to form a plurality of interlocking members with jaws and then spreading the jaws of the various members while united in the strip through distortion of the material of the members.

2. The method of forming interlocking members for separable fasteners which consists in shaping the said members while united in a strip, to form a plurality of interlocking members crosswise of the strip with crosswise extending jaws and then spreading the jaws while the various members are united in the strip.

3. The method of forming separable fasteners which consists in advancing a strip consisting of a long continuous series of united interlocking members having spread jaws end to end to place its end member in securing relation to a tape, securing the jaws on the tape, and severing the attached member from the strip.

4. The method of forming separable fasteners which consists in advancing a strip of united interlocking members having jaws arranged crosswise of the strip to place its end member in securing relation to a tape, securing the jaws on the tape and severing the attached member from the strip.

5. The method of forming separable fasteners which consists in advancing a strip consisting of a long continuous series of united interlocking members, processing the strip as it is advanced, carrying the advance of the end member into securing relation with a tape, securing the member to a tape, and severing the attached member from the strip.

6. The method of forming interlocking members of separable fasteners which consists in shaping the said members while united in a strip. to form an elongated strip of several united interlocking members in continuous series arranged end to end and oriented in the same direction, that is, the head end of one member being juxtaposed to the jaw end of the next adjacent member.

7. The method of forming interlocking members of separable fasteners which consists in shaping the said members while united in a strip to form an elongated strip of several united interlocking members with the members arranged end to end and with the jaws spread and oriented in the same direction, that is, the head end of one member being juxtaposed to the jaw end of the next adjacent member.

8. The method of forming interlocking members of separable fasteners which consists of shaping an elongated strip of such interlocking

members with jaws arranged cross-wise on the strip, with the jaws of all alternate members reversed as to relation to the edges of the strip.

9. The method of forming interlocking members of separable fasteners which consists of shaping an elongated strip of such interlocking members with jaws arranged cross-wise of the strip and with the jaws spread to receive the tape and with the alternate members having their jaws reversed relatively to the edges of the strip.

10. The method of forming interlocking members of separable fasteners which consists of shaping an elongated strip of interlocking members with jaws arranged cross-wise of the strip and with the jaws spread to receive the tape and with the alternate members having their jaws reversed relatively to the edges of the strip, and severing the strip on lines corresponding to the inclination of the jaws.

11. The method of forming the interlocking members of separable fasteners, which consists of shaping an elongated strip of interlocking members arranged cross-wise of the strip with the jaws of the alternate member in reverse relation and extending from the edges of the strip.

12. The method of forming the interlocking members of separable fasteners, which consists of shaping an elongated strip of interlocking members arranged cross-wise of the strip with the jaws of the alternate members extending from the opposite edges of the strip, and forming projections and recesses in substantial alinement for the alternate members along the strip.

13. The method of forming interlocking members for separable fasteners of the class described, in which each member has a pair of jaws, which includes spreading the jaws by force applied between the jaws and confining the material on the exterior surfaces of the jaws during such spreading action.

14. The method of forming interlocking members for separable fasteners of the class described, such interlocking members having spread-apart jaws, which includes taking a strip whose width is less than the over-all width across the spread-apart jaws, forming slots in the strip, spreading the material apart on opposite sides of each slot to provide spread jaw members united in a strip, and simultaneously confining the sides of the strip during such spreading action.

15. The method of forming slide fastener members comprising forming a strip of slide fastener members each with a head portion on one end and a pair of spread jaws on the other end in which a portion of surplus material integrally joins the head end of each member directly to the inner surfaces of the spread jaws of the next adjacent member in the strip, and punching out said surplus portion to separate the members and complete the inner surfaces of the jaws simultaneously.

16. In the method of making a strip for use in making slide fastener members, forging a continuous strip to form angular projections on opposite sides of the strip outlining the outer edges of the spread jaws of a fastener member with a portion of material between said angular projections sufficient to form one head portion of a fastener member.

17. In the method of making a strip for use in making slide fastener members, forging a continuous strip to form angular projections on opposite sides of the strip outlining the outer edges of the spread jaws of a fastener member, leaving a portion of material between pairs of said angular projections sufficient to form one head portion of a fastener member, and forming heads on such portions to provide a continuous series of partially formed fastener members in strip form.

18. In the method of forming a slide fastener member strip providing a strip of material whose width corresponds to the width of the finished fastener element, forming a series of jaws on said strip by spreading the material sidewise from about the middle of the strip with the ends of said spread jaw portions integrally connected to an adjacent portion of the strip of the original width.

19. A strip for use in making slide fastener members of the type having a head portion at one end and a jaw portion at the other end, the members being arranged in the strip in end to end relation and oriented in the same direction, the strip having along its longitudinal central portion a series of equally spaced formed heads each with a projection on one side and a formed recess on the opposite side, the sides of the strip being formed to conform to portions of the outer surfaces of the jaws, each of the heads being integrally jointd to the jaw end of the next adjacent member in the strip at the inner portions of such jaws, the ends of the jaws of all members in the strip being at least partially exposed.

20. A strip for use in making slide fastener members of the type having a head portion at one end and a jaw portion at the other end, the members being arranged in the strip in end to end relation and oriented in the same direction, the sides of the strip having angular projections conforming to tha outline of the outer surfaces of the spread apart jaws of slide fastener members including not only the sides but also the ends of the jaws, and wherein the head of each member is integrally joined to the jaw end of the next adjacent member at the inner portions of such jaws.

21. A strip for use in making slide fastener members of the type having a head portion at one end and a jaw portion at the other end the members being arranged in the strip in end to end relation and oriented in the same direction, the strip having along its longitudinal central portion a series of equally spaced formed heads each with a projection on one side and a formed recess on the opposite side, the sides of the strip being formed to conform to the portions of the outer surfaces of the jaws, the portions of said strip between said head portions having disposed therein within the last-named surfaces slots conforming to the inner surfaces of the jaws of said fastener members, each of the heads being integrally joined to the jaw end of the next adjacent member in the strip at the inner portions of said jaws, the jaws being at least partially spread and the ends of the jaws of all members in the strip being at least partially exposed.

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DEFENDANT'S EXHIBIT "BJ"

W. A. Behrens Patent No. 2,267,783

Filed Dec. 28, 1939 Patented Dec. 30, 1941

Dec. 30, 1941. W. A. BEHRENS 2,267,783

APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

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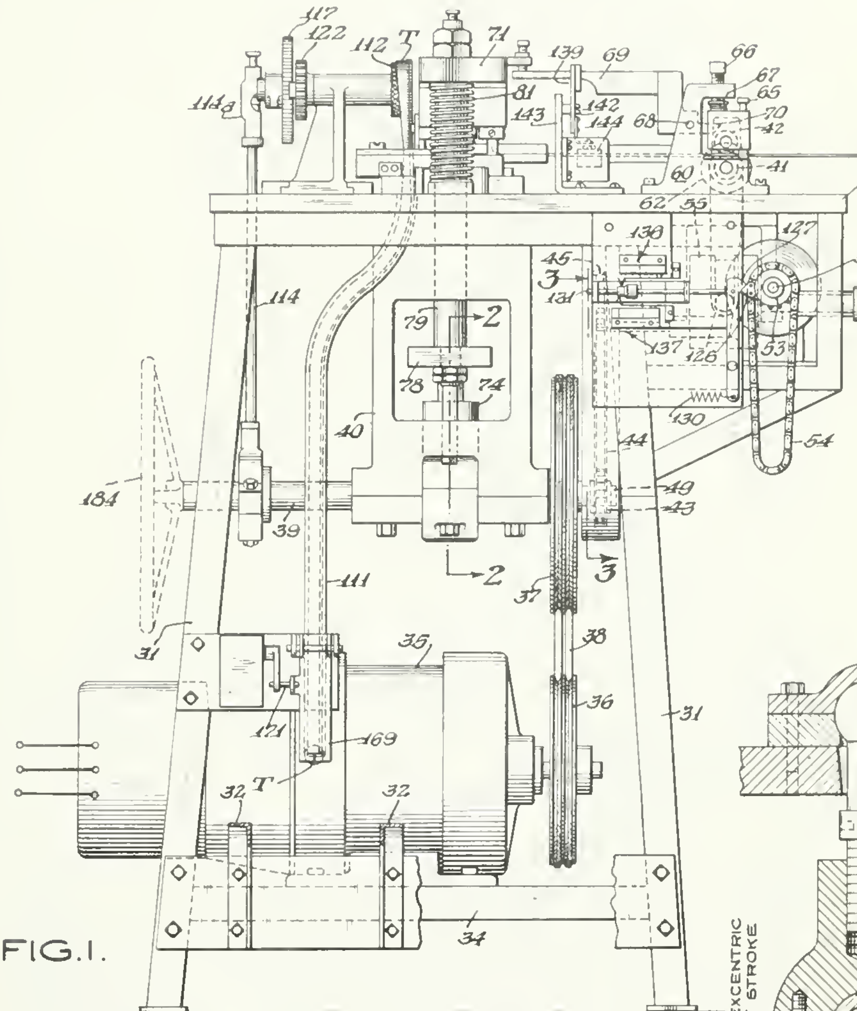

FIG. 1.

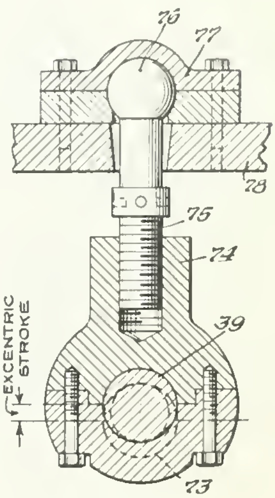

FIG. 2.

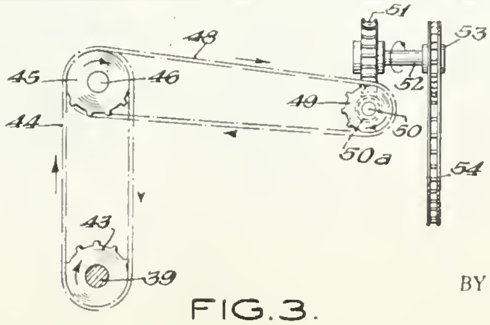

FIG. 3.

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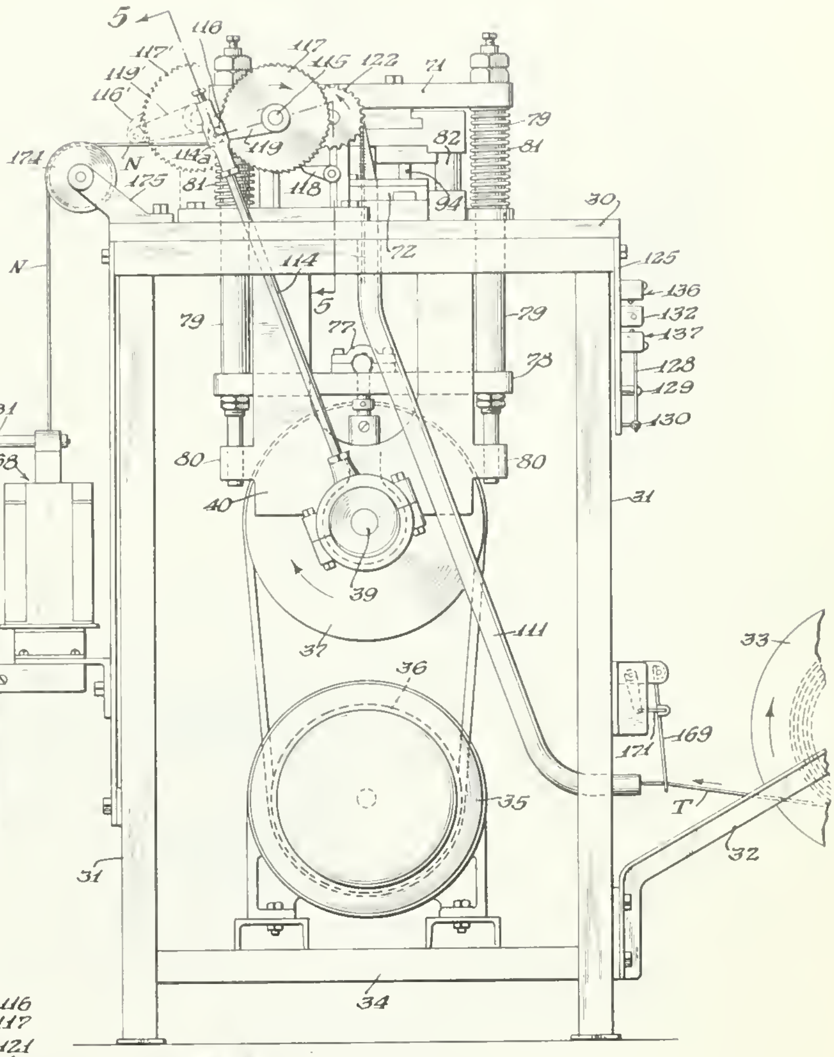

FIG. 4.

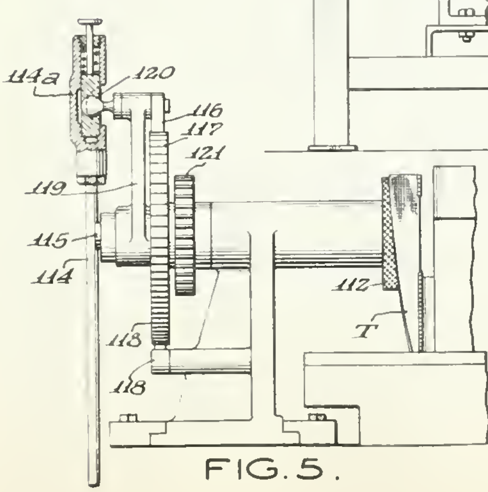

FIG. 5.

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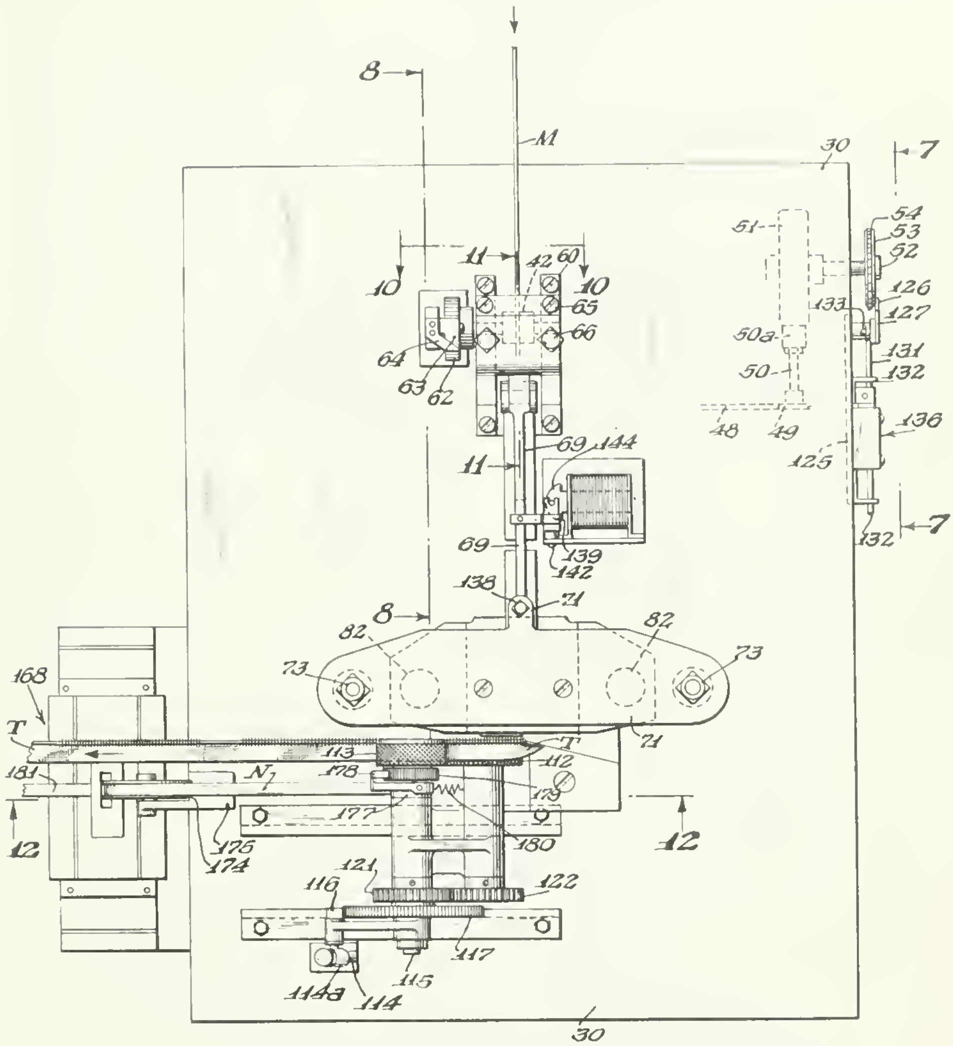

FIG. 6.

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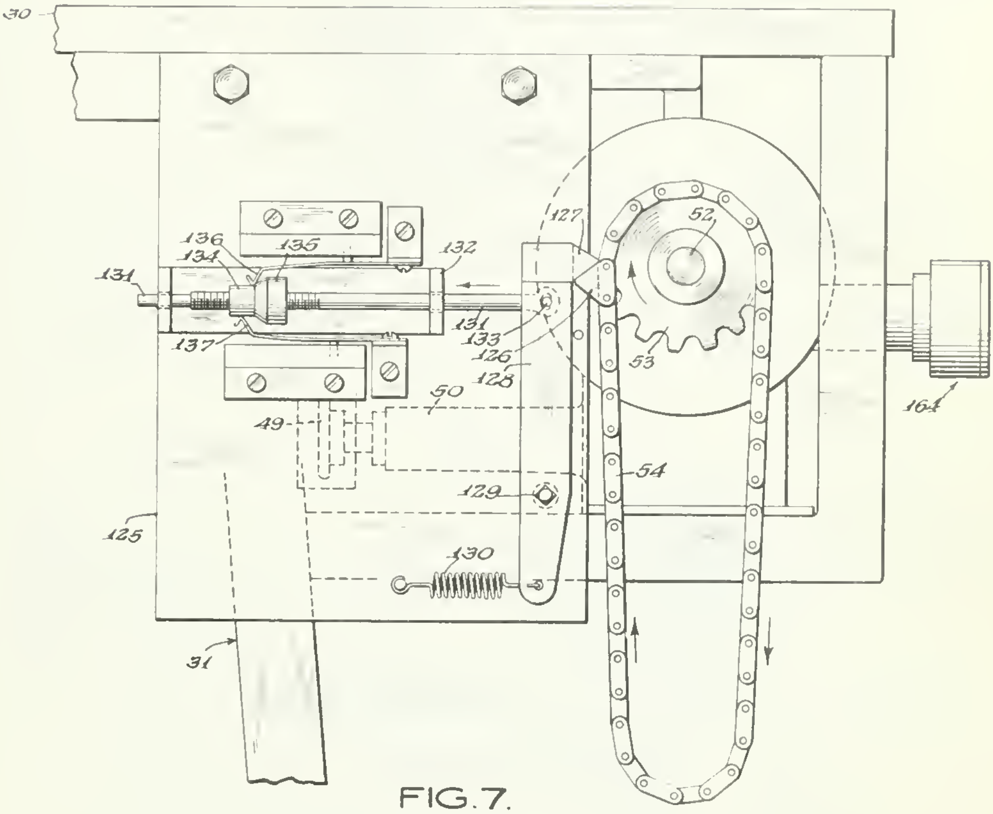

FIG. 7.

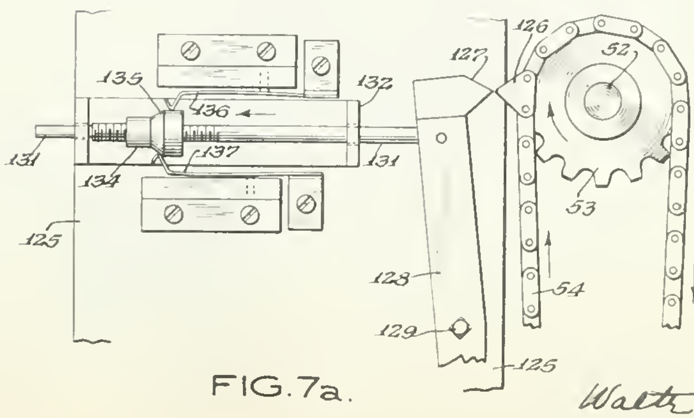

FIG. 7a.

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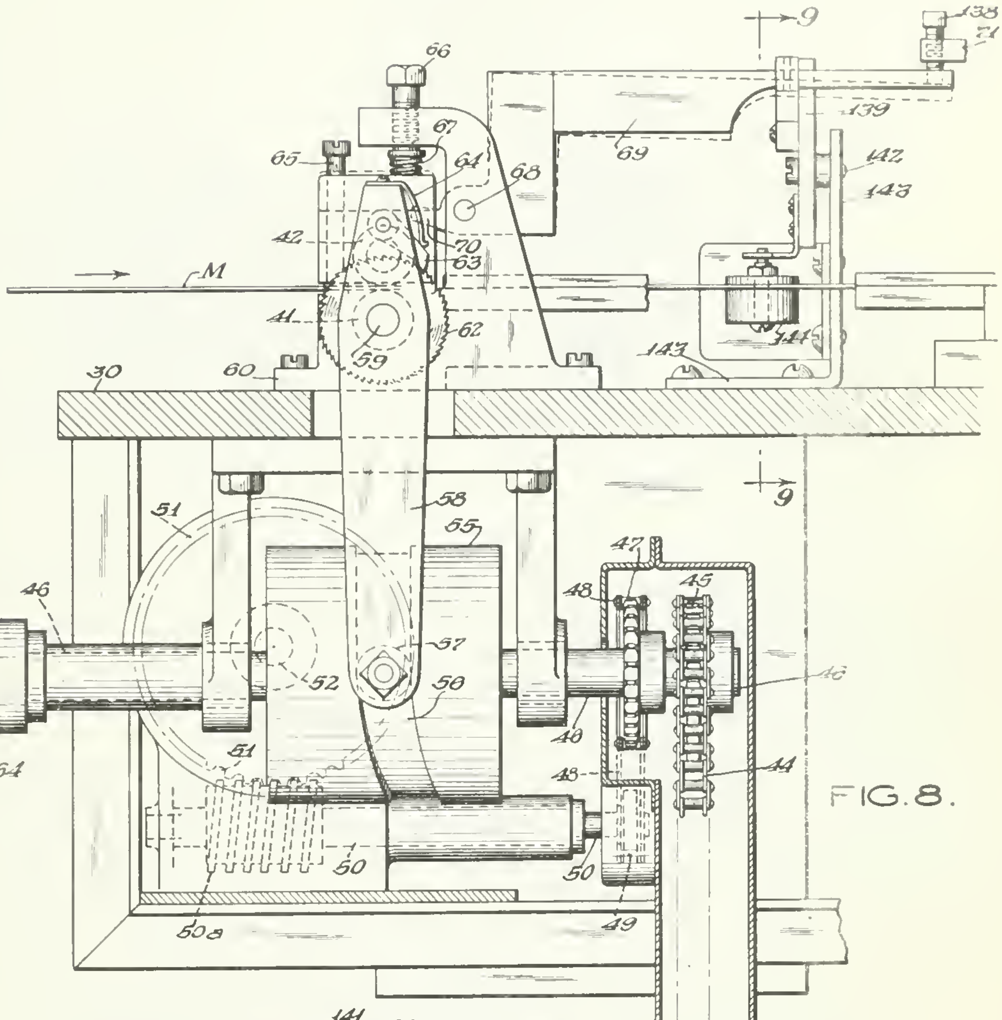
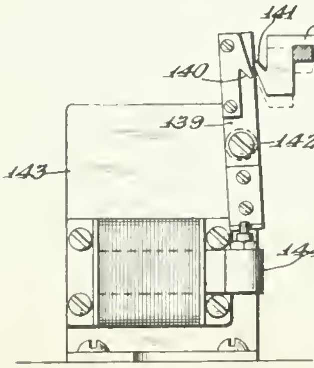


FIG. 8.



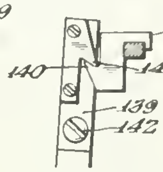


FIG. 9a.

FIG. 9.

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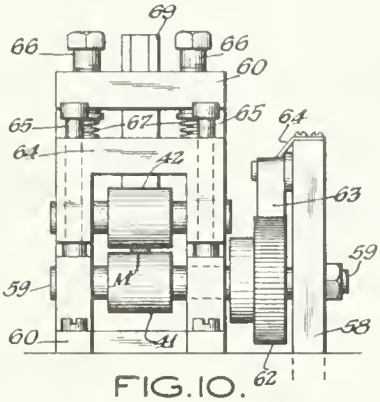


FIG. 10.

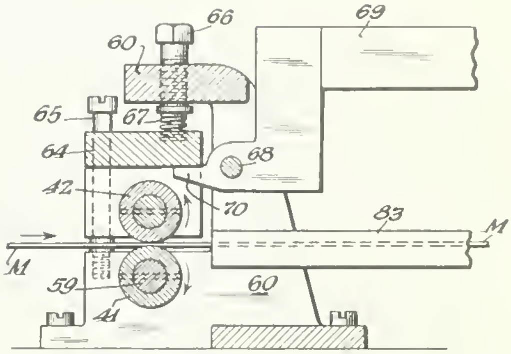


FIG. 11.

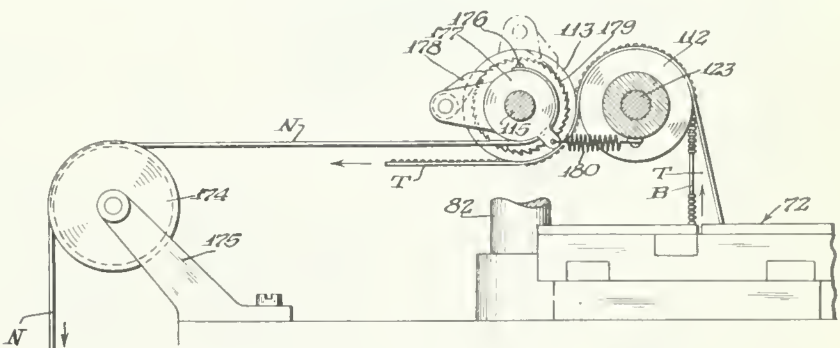
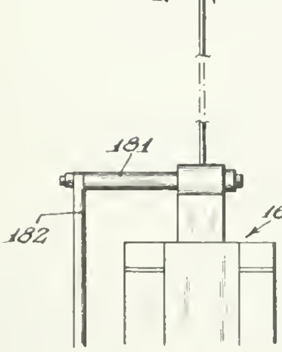


FIG. 12.



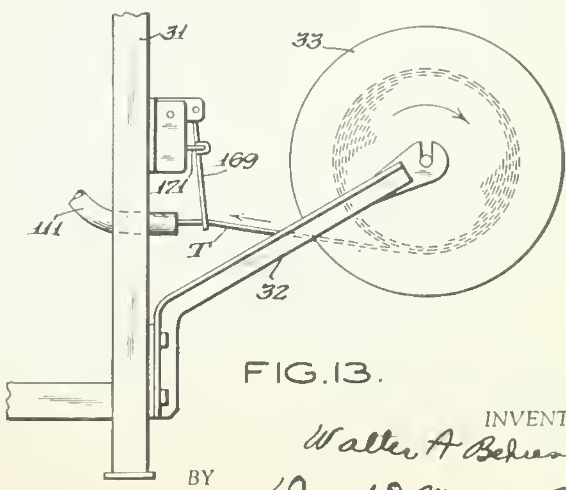


FIG. 13.

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APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

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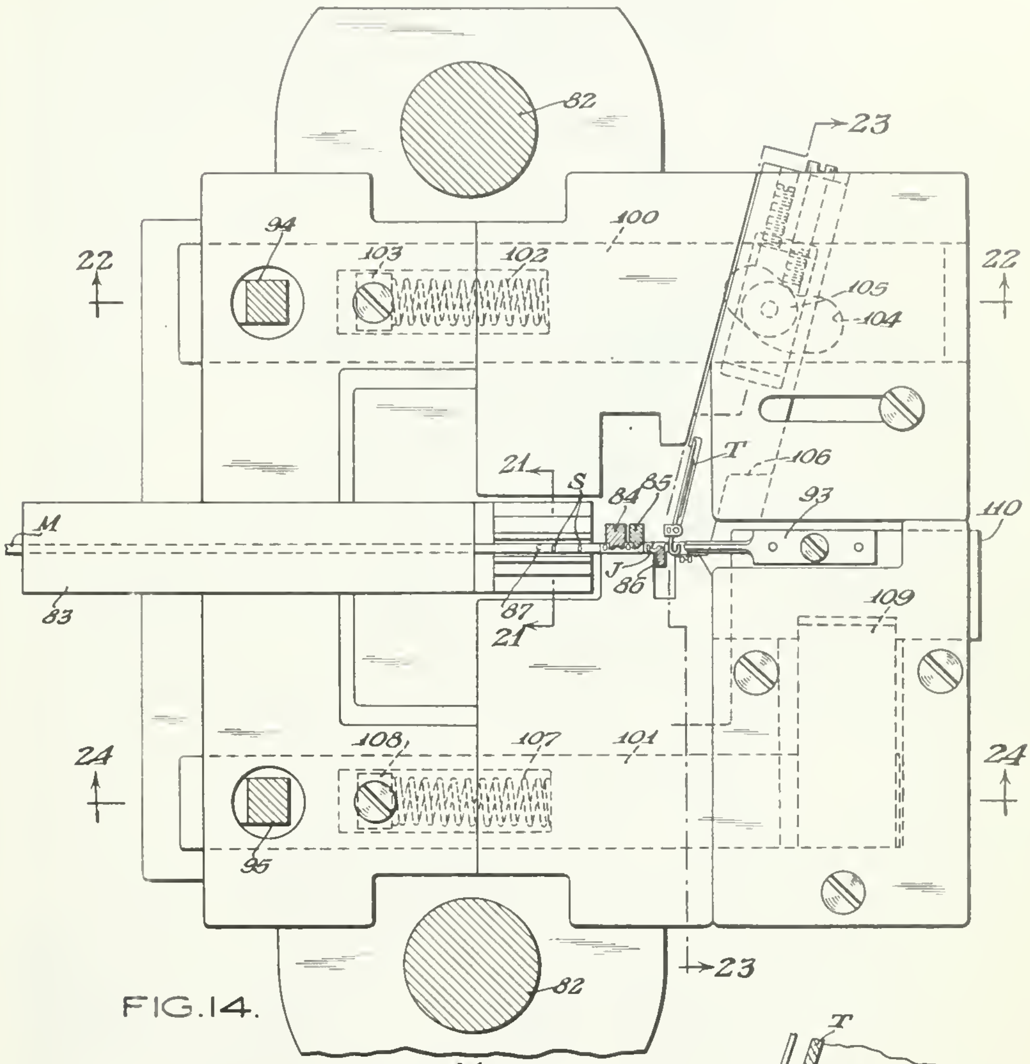

FIG.14.

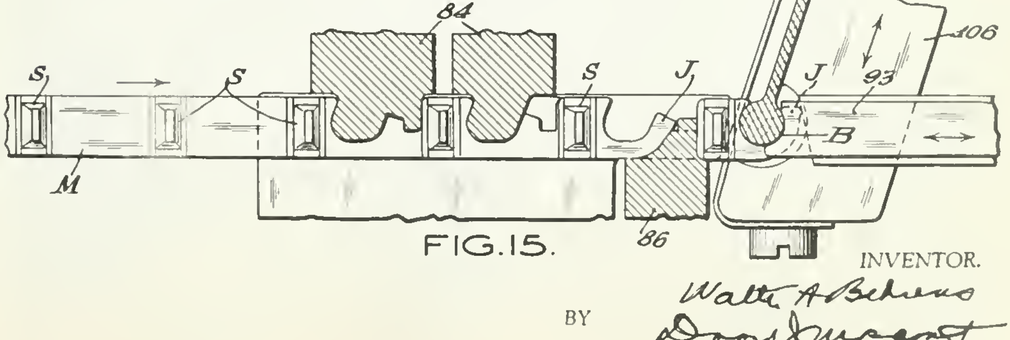

FIG.15.

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APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

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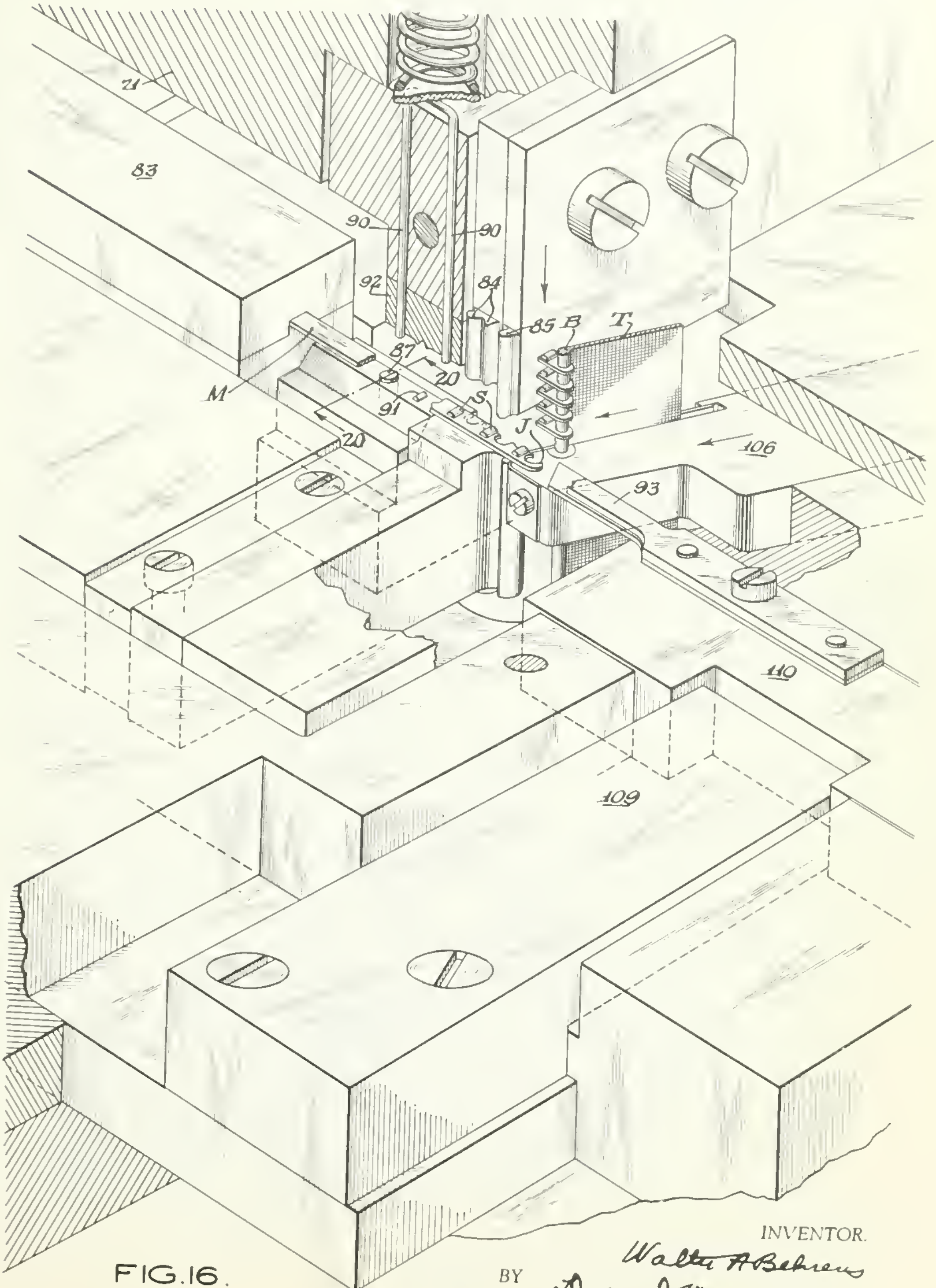

FIG.16.

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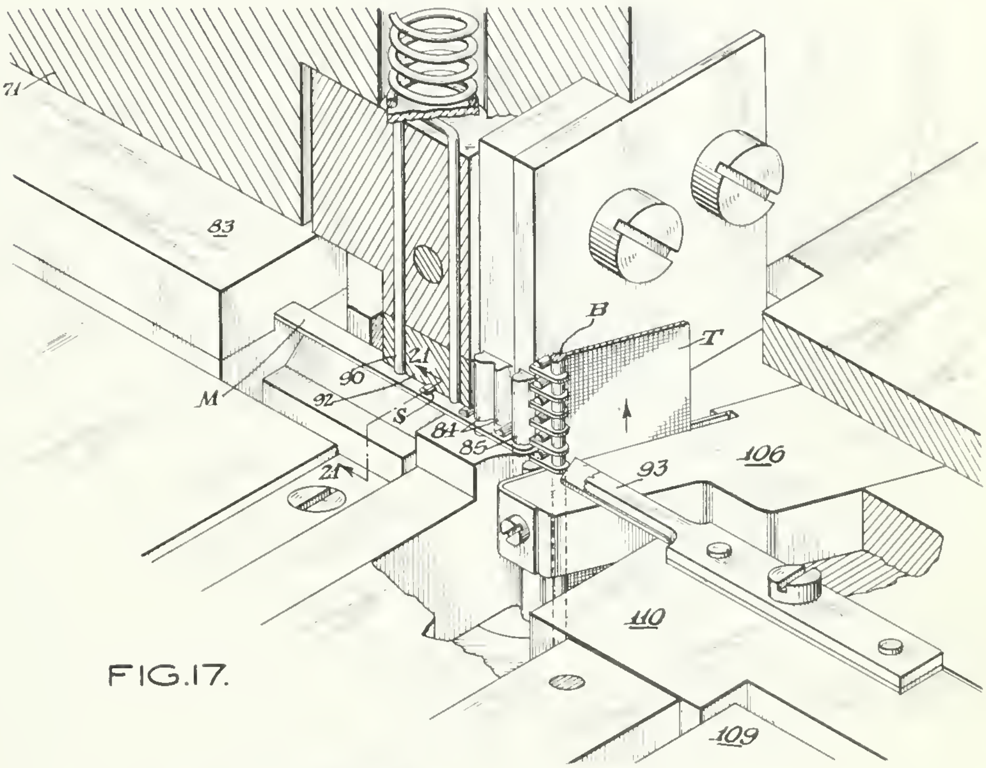

FIG.17.

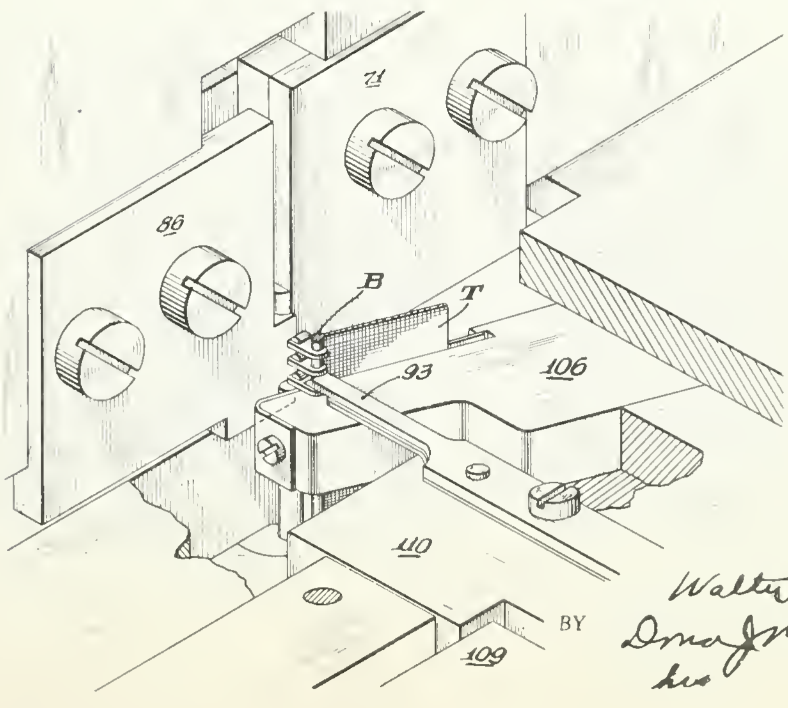

FIG.18.

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APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

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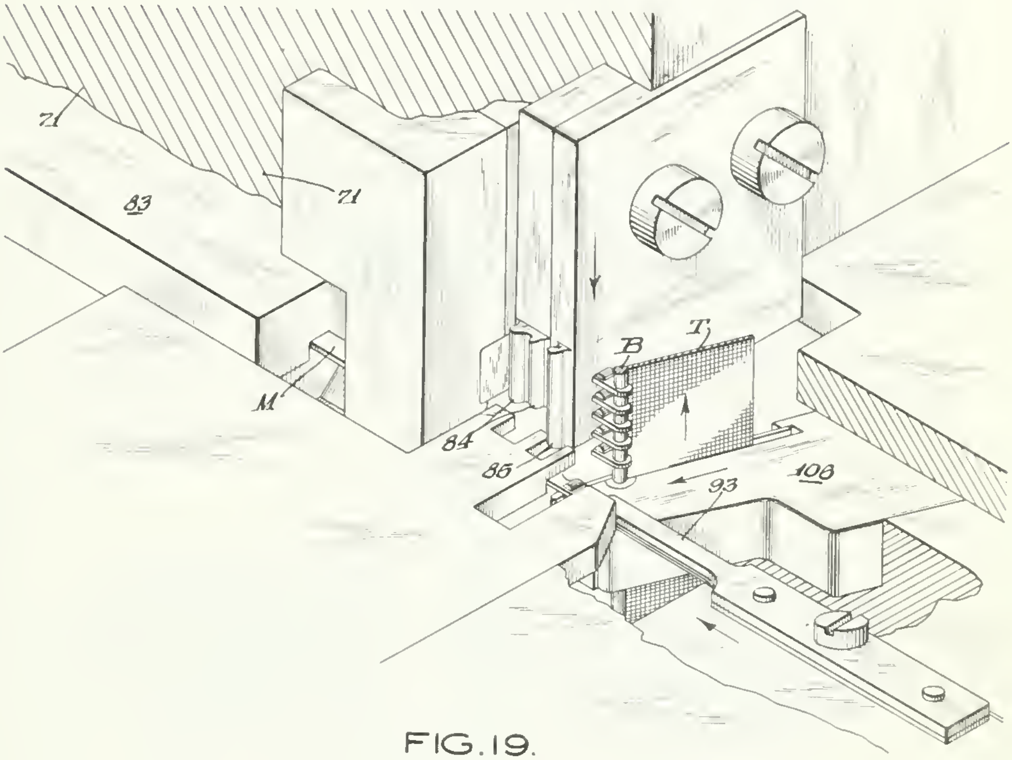

FIG.19.

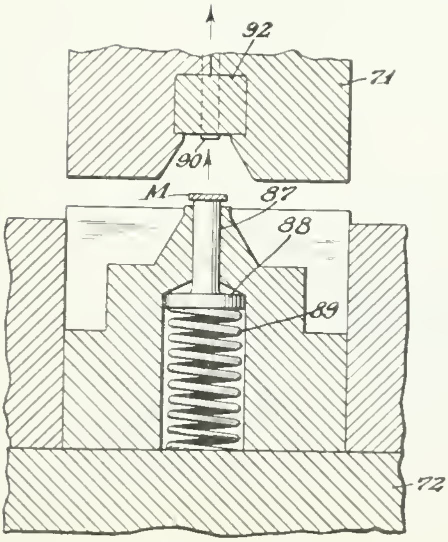

FIG.20.

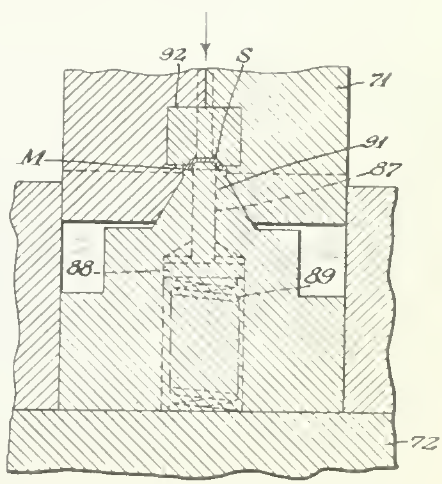

FIG.21.

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APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

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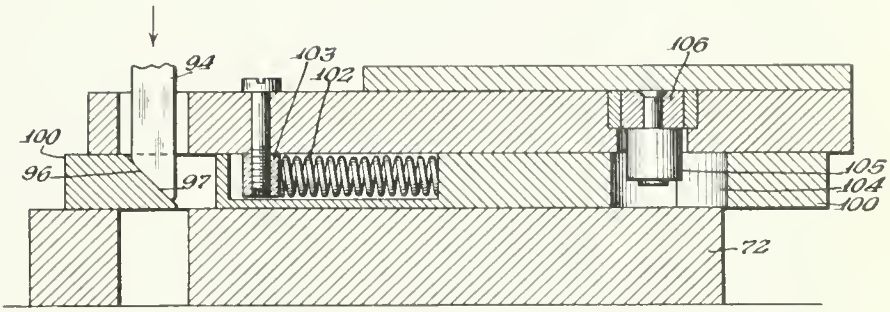

FIG.22.

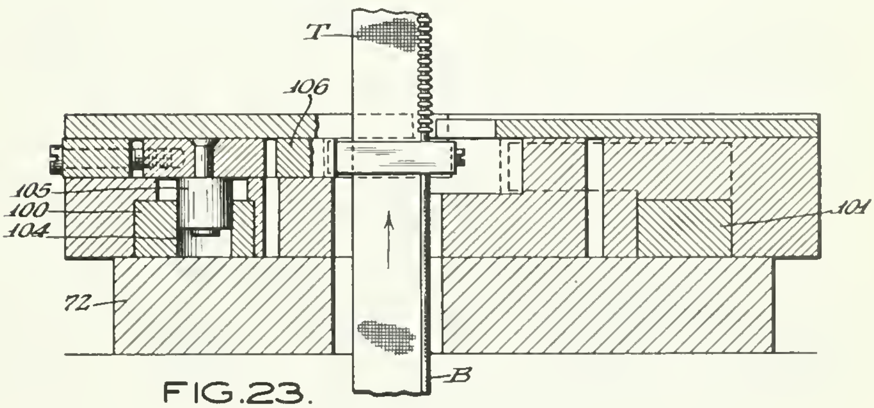

FIG.23.

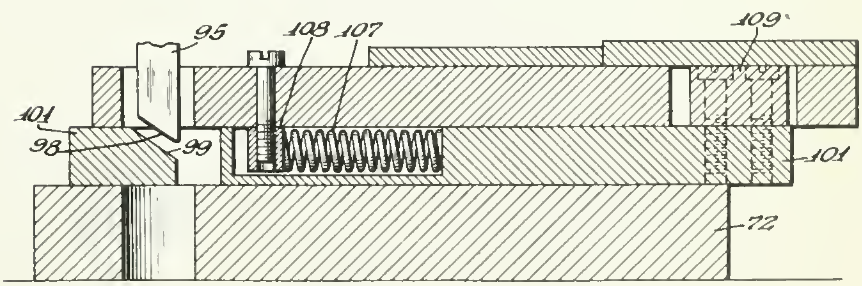

FIG.24.

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Dec. 30, 1941. W. A. BEHRENS 2,267,783

APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

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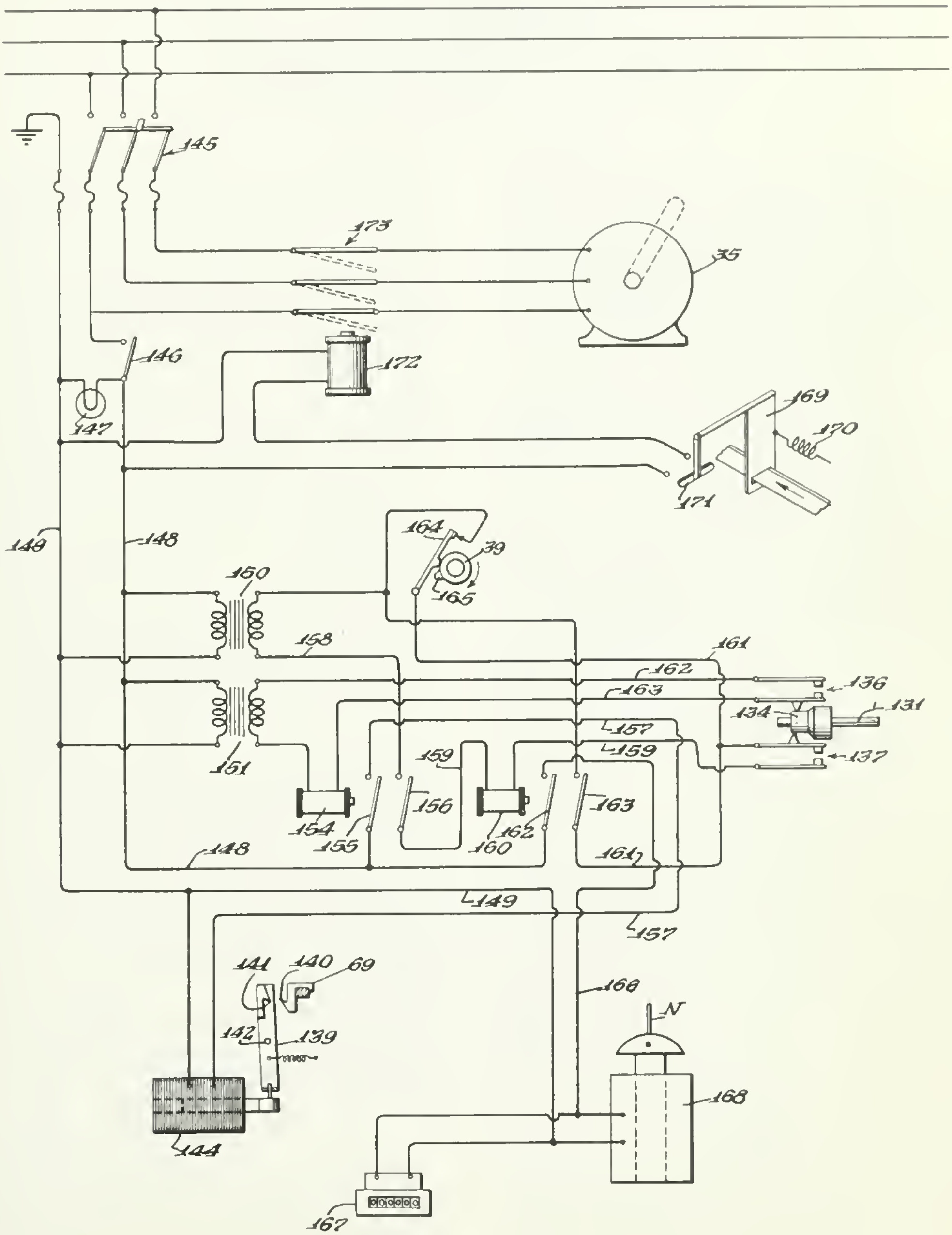

FIG. 25.

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2,267,783

APPARATUS FOR MAKING SLIDE FASTENER STRINGERS

Walter A. Behrens, Jamaica, N. Y., assignor to Port Fastener Corporation, New York, N. Y., a corporation of Delaware

Application December 28, 1939, Serial No. 311,398

14 Claims. (Cl. 153—1)

This invention relates to improvements in the apparatus for forming continuous slide fastener stringers.

Broadly, it is an object of this invention to provide a novel apparatus for intermittently forming and securing scoops onto a tape in spaced relationship in association with a tape jump mechanism which rapidly and efficiently forms separation zones between groups of the scoops. This case is a continuation in part of my copending application, Serial No. 241,195, filed on November 18, 1938, and entitled "Method of and apparatus for forming slide fastener stringers."

In accordance with the present invention the slide fasteners are made in a continuous manner using a continuous metal strip progressively shaped into scoops having head and jaw portions intermittently clamped in spaced relationship onto the tape. The tape is correspondingly intermittently displaced transversely of its normal feed path during its rest period to the jaws of the scoops. After scoop clamping operations, the tape is returned to its position for the intermittent advancing operation.

An important feature of the present invention resides in the novel apparatus for effecting a jump or predetermined spacing between attached groups of scoops to determine the length of the slide fasteners produced. Previous attempts providing such spaces have been unsatisfactory in that the either too large time interval was required, or that undue mechanical strains were encountered in the machine, or shorter periods were used. The present invention is directed to novel electro-mechanical means for effecting the tape jumping operation between scoop fastening cycles to effect the blank spaces on the tape in a predetermined manner. A timing chain is employed coupled to the machine drive for synchronous operation and adjusted in length to initiate the jumps in predetermined relation with the stringer formation.

Electro-mechanical arrangements are provided for effecting the tape jumps of any desired length within the order of four or less cycles or strokes of the machine, a cycle corresponding to the time between successive scoop forming and attaching operations. The rapid jumping or advancing of the tape for the blank sections thereof renders the production of a given machine more efficient as to the stringer output, which in practical embodiments may be as high as 25% or greater. Novel interlocking arrangements are incorporated in the mechanism to insure safety during the tape jumping intervals without interfering with the associated operations of the machine or unduly straining the mechanism.

It is accordingly among the objects of the present invention to provide a novel means for jumping or otherwise accelerating the advancement of the tape during stringer formation to substantially speed up the overall production of stringers in a given machine; to provide novel electromechanical tape jumping means employing a continuously driven timer chain and associated successively operated relays which are interlocked to insure proper jumping of the tape without interfering with the other components thereof; and to provide a novel tape jumping arrangement operated independently of the stringer machine, and without straining any portion of the mechanism thereof.

These and other objects of the present invention will become more evident in the following description taken in connection with the drawings, in which:

Figure 1 is a front elevation of a preferred embodiment of the apparatus for forming slide fastener stringers in accordance with the present invention.

Figure 2 is an end elevation taken in section along lines 2—2 of Figure 1.

Figure 3 is an end elevation taken in section along lines 3—3 of Figure 1.

Figure 4 is a side elevation of the apparatus.

Figure 5 is an end elevation taken in section along lines 5—5 of Figure 4.

Figure 6 is a plan view of the apparatus.

Figure 7 is an end view of the timing chain and associated parts taken along lines 7—7 of Figure 6.

Figure 7*a* is a view similar to Figure 7 showing the timing chain and the contact operated thereby in a different position.

Figure 8 is an end elevation taken in section along lines 8—8 of Figure 6.

Figure 9 is an end view of a hook and latch parts associated with the metal strip feed arresting mechanism, taken in section along lines 9—9 of Figure 8.

Figure 9*a* is a view similar to Figure 9 showing the hook in its latched position.

Figure 10 is an end elevation in section taken along lines 10—10 of Figure 6.

Figure 11 is an end elevation taken in section along lines 11—11 of Figure 6.

Figure 12 is an end elevation in section taken along lines 12—12 of Figure 6.

Figure 13 is a side view of the tape spool and a safety switch.

Figure 14 is a plan view of the die bed assembly, with parts thereof partially broken away.

Figure 15 is a detail plan view partly in section showing the stepwise formation of the fastener element on the continuous metal strip.

Figure 16 is a perspective view of the die assembly, the punch head being in its upper position, and the stripper plate and cut-off punch being removed.

Figure 17 is a perspective view similar to Figure 16 of the die assembly with the punch head in its lower position.

Figure 18 is a perspective view of the die assembly with the punch head in its lower position, and the stripper plate being removed.

Figure 19 is a perspective view of the die assembly, the punch head being in its upper position, and the cut-off punch being removed.

Figure 20 is an end view taken in section along lines **20—20** of Figure 16.

Figure 21 is an end view taken in section along lines **21—21** of Figure 17.

Figure 22 is an end view taken in section along lines **22—22** of Figure 14.

Figure 23 is an end view taken in section along lines **23—23** of Figure 14.

Figure 24 is an end view taken in section along lines **24—24** of Figure 14.

Figure 25 is a diagrammatic view of the electrical connections and arrangements associated with the tape jump mechanism of the present invention.

Referring to the drawings in general, the apparatus for forming continuous slide fastener stringers is shown in assembly in Figures 1, 4 and 6 and comprises (*a*) a metal strip feed; (*b*) a stringer forming mechanism comprising blanking and clamping members; (*c*) a tape feed mechanism; (*d*) a tape jump mechanism; the tape jump mechanism being operable through electrical contacts from a separate electric source, while all the other mechanisms are operable from a common mechanical drive having a common source of power.

On the table **30** of the apparatus are remounted the stringer forming mechanism, the metal strip feed, the tape feed, and the tape jump mechanism, the latter being mounted below table **30**. Table **30** is supported by legs **31** which in turn support bracket **32** carrying the tape spool **33** which supplies tape T. Cross bars **34** fastened on legs **31** support electric motor **35** which drives main shaft **39** by means of pulleys **36** and **37** operable through belt **38**. Shaft **39** is journalled in U-shaped bracket **40** mounted on table **30**.

The metal feed strip

Referring in detail to Figures 1, 3, 6, 8, 10 and 11, the metal strip feed comprises a pair of rotatably mounted rollers **41** and **42** which intermittently feed the continuous metal strip to the punch and die assembly to be described hereinafter. Roller **42** is reciprocably mounted. Sprocket wheel **43** is rotatably mounted on shaft **39** driving sprocket wheel **45** by means of chain **44**, in turn rotatably mounted on shaft **46** carrying sprocket wheel **47**. Wheel **47** drives sprocket wheel **49** by means of chain **48** mounted on shaft **60**.

Worm **50***a* is rotatably mounted on shaft **50** driving worm gear **51** mounted on shaft **52** which in turn carries sprocket wheel **53** driving time chain **54**. Cam **55** is rotatably mounted on shaft **46** and is provided with an angularly shaped groove **56**. Roller **57** provided on lever **58**, extending through table **30**, is guided in groove **56**. When shaft **46** is driven through shaft **39** by chain **44**, lever **58** which is pivoted on shaft **59** is oscillated (Figure 8). Shaft **59** is journalled in bracket **60** secured to table **30**. A ratchet disc **62** is rotatably mounted on shaft **59**. Pawl **63**, rotatably mounted on lever **58** is pressed downwardly by spring **61** and advances disc **62** one tooth at a time upon each rocking movement of lever **58**.

It will now be evident that shaft **39** drives shaft **46** by means of sprocket wheels **43**, **45** which cause cam **55** to revolve. During each revolution of cam **55** the upper arm of lever **58** is swung to the left and the right, pawl **63** advancing disc **62** tooth by tooth or several teeth at once, depending upon the shape of groove **56** and the length of the arms of lever **58**. Roller **41** is intermittently rotated by such movement of disc **62**.

Roller **42** is rotatably mounted in U-shaped bracket **64** which is reciprocably guided by screws **65** of bracket **60**. Screws **66** are fastened in bracket **60** and are provided with compression springs **67** tending to press bracket **64** downwardly, and press rollers **42** against metal strip M, as well as against roller **41**. Lever **69**, pivoted on shaft **68** mounted in bracket **60**, is provided with projection **70** which, if moved upwardly, is adapted to lift bracket **64** in turn reciprocably mounted on screws **65**. Lever **69** is adapted to be tilted by the punch head in order to allow for the tape jump, as will be described hereinafter.

The clamping and stamping assembly and operation

The blanking and stamping assembly and associated parts are shown in detail in Figures 1, 2, 4 and 14 to 24. The assembly comprises a reciprocable male punch head **71** and a female die section **72** mounted on table **30**. Eccentric **73** carried by main shaft **39** reciprocates head member **74** provided with a screw **75**, the head of which is in the form of a ball or sphere **76**. Ball **76** is received in a corresponding spherical bearing formed on curved member **77** removably fastened to cross bar **78**.

Cross bar **78** is fastened to posts **79** which are guided at **80** in bracket **40**, and which are further guided in holes (not shown) in table **30**. Springs **81** are provided between table **30** and punch head **71** which cushion the up and down movement of the punch head **71**. It will now be evident that when shaft **39** rotates, eccentric **73** reciprocates the punch head **71** by means of cross bar **78** and posts **79**. The stroke of eccentric **73** is comparatively small, as indicated in Figure 2.

The punch and die assembly will now be described in detail with specific references to Figures 14 to 24. On die bed **72** are mounted posts **82** which guide the punch head **71**. Metal strip M is fed intermittently, as described above and is guided in guide block **83** mounted in die bed **72** to prevent lateral movement thereof. On the downstroke of punch head **71** punches **84**, **85** and **86**, fastened on head **71**, simultaneously act upon the metal strip, punching and severing it. At first, however, metal strip M moves over plate **87** fastened on piston rod **88** which is actuated by compression spring **89** fastened in die bed **72**.

On the downward stroke of punch **71** plate **90** mounted in the punch head presses down plate **87** and on the upward stroke of punch **71** plate **87** lifts the metal strip a small distance from the die bed to facilitate the clearance of the punches from the metal strip M, and the subsequent feeding movement of strip M. Thereafter, scoop heads S are formed on the strip M by means of die 91 secured to the die bed and punch 92 provided on punch head 71.

After the scoop heads are formed, strip M is fed under punch 84 which cuts out a predetermined outline, as shown in greater detail in Figure 15. Punch 85 serves to hold the strip in a particular position in order to insure proper severance, by severing punch 86 on the proper plate. The individual scoops are thus provided with a jaw J which serves to fasten it onto the bead B of tape T in the manner set forth in detail in the copending application referred to above. The scoops are severed from metal strips M in the last stage of their formation, as shown in Figure 15.

The synchronized movements of tape T and stringer clamping block 93 will now be described. The male punch carries two posts 94 and 95 provided with bevel formations 96 and 98 respectively, cooperating with beveled surfaces 97 and 99 provided in the reciprocably mounted plates 100 and 101 which in turn actuate tape carrying block 106 and clamping block 93. As may be seen in Figures 22 and 24, post 94 is somewhat longer than post 95. This causes beveled surface 96 to first engage with cam 97 of plate 100.

The downward stroke of the male punch causes a displacement to the left of plate 100, Figures 14 and 22. A compression spring 102 is arranged between plate 100 and screw 103 fastened in the die bed. Plate 100 is provided with an angularly shaped groove 104 into which fits roller 105 provided on tape carrying plate 106. A displacement of plate 100 to the left (Figure 14), causes tape carrying plate 106 to move downwardly. Coacting groove 104 is shaped so that a downstroke of punch head 71, causing a displacement of plate 100 to the left, produces at first a rapid movement of tape carrying plate 106 and, thereafter, downward movement of post 94 does not cause further movement of tape carrying plate 106.

When the male punch moves further on downwardly, surface 98 contacts surface 99, causing a displacement of plate 101 to the left (Figure 14). Spring 107, arranged between plate 101 and screw 108 fastened on the die bed, serves to return plate 101 upon the upward stroke of the male punch. Plate 109, being integral with plate 101, is also moved to the left upon the downward stroke of the punch, and plate 109 in turn moves plate 101 carrying clamping punch 93.

The downward stroke of the male punch accordingly causes plate 100 to move to the left, and thereafter the movement of plate 101. The movement of plate 100 causes a downward movement of tape carrying plate 106, bringing tape T from the position shown in Figure 16 to that shown in Figure 17, i. e. into alignment with the metal strip M. Further downward movement of the male punch head does not produce a corresponding further movement of tape carrying plate 106. The movement of plate 101 towards the left (Figure 14) causes a corresponding movement of plate 110, carrying clamping punch 93, following the movement of plate 106. After tape T is in alignment with metal strip M clamping punch 93 presses jaw J against bead B, and severing punch 86, which has previously been moved down by the male punch, holds the scoop firmly while jaw J is clamped on bead B of tape T.

On the upward stroke of the male punch, punches 84, 85 and 86 move also upward, releasing the metal strip. Plates 100 and 101 are thereupon released from beveled surfaces 94 and 95, and springs 102 and 107 return plates 100 and 101 into their original position. The return movement of plates 100 and 101 causes the clamping punch 93 to move away from the metal strip, and tape carrying member 106 then moves out of alignment with the metal strip. The metal strip is then free to advance another step while the tape T is also free to advance into a position for the next scoop to be clamped onto its bead B.

The tape feed arrangement

The tape feed arrangement is shown in Figures 1, 4, 5, 6, 12 and 13. The tape is unwound from spool 33, passed through tube 111, moved through a hole in table 30 and through tape carrier plate 106. Tape T is fed by the intermittent rotation of knurled wheels 112 and 113, in the following manner. On main shaft 39 is mounted an eccentric (not shown) which reciprocates lever 114, caused by the rotation of shaft 39 and operates pawl 116 over ratchet disc 117. Reverse movement is prevented by pawl 118.

Disc 117 is fastened on shaft 115 which carries knurled wheel 113. Arm 119 of lever 114, which carries pawl 116 and which connects lever 114 with shaft 115, is journalled in ball joint 120. Gear 121, mounted on shaft 115, meshes with gear 122 in turn mounted on shaft 123 carrying knurled wheel 112. Thus, lever 114 advances wheel 117 one or several teeth for each revolution of shaft 39, causing a positive rotation of knurled wheels 112 and 113 in opposite directions through the intermediary of gears 121 and 122. An important feature of the reciprocatory drive of ratchet disc 117 resides in the detachability of driving rod 114 from crank 119 and operating pawl 116 to permit ready access to the tape T within the mechanism. Towards this end, a removable connection 114*a* is provided at the top end of rod 114 and crank arm 119. The ball joint 120 is removable from its connection 114*a* on rod 114, through the spring joint connection shown. When thus dissembled the assembly carrying pawl 116, ratchet disc 117, and arm 115, is movable to the left in Figure 4 as indicated in dotted at positions 116′, 117′ and 119′, to permit access to tape T.

The time chain, metal feed latch and tape jump mechanism

An important feature of the present invention resides in materially reducing the time required in providing the blank spaces or jumps between successive stringer sections. In the preferred arrangement to be described, a blank space or jump of any desired length is made feasible within four strokes or cycles of operation of the machine, so as not to strain the machinery or require any excessive rate of speed therein. Each stroke corresponds to the cycle required for attaching a single scoop on tape T. Thus, in a practical case, where an 8-inch zipper or stringer is made, 22 strokes or cycles of operation of the machine is generally employed for the space between successive completed stringers. In accordance with the present invention, the 22-cycle space is provided by a corresponding jump of the tape, preferably within four strokes or cycles of the machine. This corresponds to an increase in the production capacity of 20% in making the 8-inch zippers. Corresponding production increases will apply for different lengths of stringers.

In accordance with the preferred arrangement for effecting the predetermined tape jumps, electro-mechanical means are used with interlocking controls to prevent destructive action in event of electric contact failure. Electrical controls are provided to select the proper phase of the cycle in which the jump takes place, which phase corresponds to the time when the tape is free to move, and no scoop element is being attached thereon. The jumping mechanism is operated through separate electrical control means without straining any mechanical operation of the stringer making mechanism.

Referring now to Figures 1, 3, 7, 7*a*, the timing chain **54** is shown, arranged on sprocket wheel **53** for determining the length of the individual slide fasteners or stringers by initiating the tape jumping action referred to. As described above, pulley **53** is actuated by main shaft **39** through sprocket wheels **43**, **45** driven by sprocket chain **44**, by sprocket wheels **47**, **47** driven by sprocket chain **48**, and by worm and worm gear **50*a***, **51**. Timing chain **54** is thus rotated when shaft **39** is rotated. Arm **124** is mounted on leg **31**. Bracket **125** is fastened to the table **30** and to arm **124**. Shaft **52** of sprocket wheel **53** is journalled in bracket **125**.

Timing chain **54** is provided with a projecting dog or lug **126** cooperating with projection **127** of lever **128** pivotally mounted on bracket **125** at **129**. The shorter arm of lever **128** is provided with spring **130** fastened on bracket **125**, biasing it to the left (Figure 7). Rod **131** is guided at **132** in bracket **125** and is pivotally mounted at **133** on lever **128**. Rod **131** is provided with an adjustable ring **134** having a shoulder **135** which is adapted to actuate cam or spring switches **136** and **137**.

When dog **126** contacts projection **127**, rod **131** is pushed to the left as shown in Figure 7*a*, and shoulder **135** of ring **134** operates electrical switch arms **136** and **137**. Switches **136** and **137** are arranged in such manner that switch **136** is closed first and switch **137** thereafter. Switches **136** and **137** control the operation of the tape jump mechanism. The length of timing chain **54** and its rate of travel determine the stringer length, i. e., the number of scoops on each chain or group spacedly fastened on tape T. The length of the completed slide fasteners is determined by adjusting the length of chain **54**.

As will be explained in detail in connection with Figures 8, 9, 9*a*, 10 and 11, the closing of switch **136** by timing chain **54** operates the metal feed latch to arrest the advance of strip M. Lever **69**, pivoted at **68**, lifts bracket **64** by means of projection **70**. Punch head **71** actuates lever **69**. Adjusting screw **138** serves for adjustment of the rocking movement of lever **69**. Metal strip M can only be fed when roller **42** presses against roller **41**. However, when projection **70** of lever **69** lifts bracket **64**, roller **42** is disengaged from roller **41**.

Ordinarily, roller **42** will be disengaged from roller **41** only during the downstroke of punch head **71**. Lever **69** is provided with hook **140** which cooperates with hook **141** of lever **139**, rotatably mounted on screw **142**, in turn fastened to bracket **143** mounted on table **30**. Magnet **144**, also mounted on bracket **143'** is adapted, when energized, to pull lever **139** towards the magnet, causing hook **141** to engage with hook **140** during the downstroke of punch head **71**.

Lever **69** is then held by hook **141** in the position shown in dotted lines in Figure 8, when projection **70** lifts bracket **64** and roller **42** disengages roller **41**. Rotation of roller **41** does not advance the metal strip as long as hook **141** engages with hook **140** of lever **69**. However, as soon as magnet **144** is deenergized, the downstroke of punch head **71** disengages hooks **140** and **141**. Upon the upstroke of punch head **71**, roller **42** will engage roller **51** and advance the metal strip M one step further.

The operation of the tape jump mechanism will now be described, particularly in connection with Figures 25, 4 and 12. As shown in Figure 25, motor **35** is a three-phase motor, supplied by the main current supply through main switch **145**. A switch **146** is provided in current lead **148**. Pilot lamp **147** serves to indicate when lines **148** and **149** are energized. Transformers **150** and **151** are provided in the circuit for reducing the voltage applied for the two relay circuits to be described.

When switch **136** is closed, through the action of timing chain **54**, leads **152** and **153** are interconnected with transformer **151**, energizing relay **154** to cause the closing of switches **155** and **156**. Closure of switch **155** connects line **148** with lead **157**, thus energizing strip M feed arresting magnet **144**. This action effects the latching of lever **69**, preventing further intermittent feeding of metal strip M. The movement of ring **134**, actuated by dog **126** of timing chain **54** thus first causes the inaction of the metal feed roller **42**, stopping strip M.

The next operation in the cycle comprises the closing of switch **137** which connects transformer **150** with relay solenoid **160** by means of lead **158** through switch **156** previously closed by relay **154** through the action of switch **136**. This is a safety interlocking action. The circuit is thus completed for relay **160**, which closes switches **162** and **163**. It will now be evident that relay **160** can only be actuated when switch **156** has previously been closed, assuring that the next step may take place only when metal strip M feed latch is actuated. It will further be evident that relay **160** can only be actuated when timer switch **164** is closed.

Timer switch **164** is cyclically operated by cam **165** on main drive shaft **39**. Opening of timer switch **164** takes place only during the downstroke of the punch head, i. e., when tape T is moved into the path of metal strip M by tape carrier plate **106**. Switch **164** is thus closed only when tape T is free to be advanced or jumped. When closed, switch **162** connects lead **148** with lead **166**, which in turn connects a counter device **167** in parallel with jumper magnet **168**, to mains **148**, **149**.

Counter device **167** counts the individual slide fasteners or stringers formed by the machine. The purpose of jumper magnet **168** will become apparent shortly. The closing of switch **163** short-circuits timer switch **164**. When relay **160** is actuated, the cyclic opening of timer switch **164** thus does not interrupt the current energizing magnet **168**, or otherwise interfere with the tape jumping operation.

Safety switch **171**, see also in detail in Figures 4 and 13, is actuated by lever **169** provided with spring **170**. Should tape T, unwinding from spool **33** be bent over or otherwise not be smooth, lever **169** closes switch **171**, which energizes relay **172** to open switch 173, disconnecting motor 35 from the main current supply, and stop the operation of the machine.

The actual tape jump mechanism of the disclosed embodiment may be seen in Figures 4 and 12. Should jump magnet 168 be energized as described herein, pull cord N, guided over pulley 174 rotatably mounted on bracket 175, is drawn downwards as indicated by the arrow. Cord N is fastened to disc 177 by screw 176, which disc is rotatably mounted on shaft 115. Pawl 178 is mounted on an extension of disc 177, and engages ratchet 179 fixedly mounted on shaft 115. Spring 180, fastened to disc 177, biases disc 177 counterclockwise.

When jump magnet 168 is energized, pull cord N rotates disc 177 clockwise, causing pawl 178 to turn ratchet 179 by a predetermined angular amount. Knurled roller 113, fastened to shaft 115, is rotated together with ratchet 179, pulling tape T by knurled rollers 112 and 113 by an amount corresponding to the movement of cord N. This distance is the exact predetermined jump distance required between the stringers, and is effected fully within four strokes of operation. The time interval of passage or action of the dog 126 of chain 54 corresponds to the four strokes or cycles. More or less strokes may be thus employed.

When magnet 168 is deenergized, cord N returns to its inoperative position through the action of biasing spring 180. Knurled rollers 112 and 113 then resume their intermittent feed of tape T through the action of ratchet 117 as described. To dampen the movement of pull cord N by magnet 168, dash-pot or mechanical damping device 183 is used, as shown in Figure 4. Towards this end, rod 182 of pneumatic plunger device 183 is coupled to the plunger of jump magnet 168. A hand wheel 184, shown in dotted lines in Figure 1, may be provided on main drive shaft 39 to permit manual rotation of this shaft. Spring 130 (Figure 7) biases switch rod 131 to the left to open circuit switches 136, 137 when dog 126 passes to restore normal stringer forming operation in the machine.

In summary, the novel tape jumping arrangement of the present invention operates as follows: The timer chain is driven at a predetermined rate in synchronism with the driving of the machine, and contains a projection or dog 126 which initiates the tape jumping operation at predetermined intervals. The length of the chain is adjustable for different blank spacings or lengths of stringers, as is understood. When timer chain dog 126 presses against projection 127 of lever 128 (Figure 7, 7*a*) electrical switches 136 and 137 are successively closed to correspondingly successively operate relays 154 and 160. The energization of relay 154 causes solenoid 144 to move latch portion 141 towards latch 140, to arrest the feeding of the metal scoop strip M, as described in connection with Figures 8, 9, 9*a* and 11.

Relay 160, being interlocked through switch 156, cannot be energized until relay 154 has first been energized, and therefore until the feeding of metal tape M is arrested. Relay 160, furthermore, cannot be energized except when timer switch 164 is closed, as determined by timer cam 165, when the punch is out of the die and tape T is free to be moved. Thereupon, tape advancing solenoid 168 is energized to move pull-cord N a predetermined amount as disclosed in connection with Figure 12. A cushioning means, such as air cylinder 183, (Figure 4) is attached to the plunger of solenoid 168. The movement of pull-cord N advances ratchet disc 179 a predetermined amount which, due to attached knurled feed roller advances tape T the predetermined length corresponding to the desired blank space. An electro-magnetic counter 167 is connected in circuit with solenoid 168 to count the number of jumps performed by the machine, and therefore corresponds to the number of completed slide fasteners made. The cycle is repeated for each revolution of timing chain 54.

Although a preferred embodiment of the stringer forming and tape jumping mechanism has been disclosed in accordance with the present invention, it is to be understood that variations and modifications therein may be made coming within the broader spirit and scope thereof, as defined in the following claims.

What I claim is:

1. The combination with a continuous slide fastener forming machine having apparatus for successively attaching scoops onto a tape, of means for producing blank spaces between groups of scoops on the tape comprising an instrumentality for jumping the tape, and means for controlling the operation of said instrumentality in synchronism with the continuous operation of the machine comprising a timing component and electrical switching means actuated by said component, and a timer switch in circuit with said switching means to insure energization thereof only at a predetermined phase in the cycles of operation of the machine.

2. The combination with a continuous slide fastener forming machine having apparatus for successively attaching scoops onto a tape, of means for producing blank spaces between groups of scoops on the tape comprising an instrumentality for jumping the tape, and means for controlling the operation of said instrumentality in synchronism with the continuous operation of the machine comprising a timing chain with a dog driven synchronously with the machine, electrical switching means intermittently actuated by said dog, and a timer switch in circuit with said switching means to insure energization thereof only at a predetermined phase in the cycles of operation of the machine including circuit connections to render said timer switch ineffectual upon energization of said switching means whereby the tape jumping operation may occur over an interval of several cycles of operation of the machine.

3. The combination with a continuous slide fastener forming machine having apparatus for successively attaching scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising an instrumentality for jumping the tape, and means for controlling the operation of said instrumentality in synchronism with the continuous operation of the machine comprising a timing chain with a dog driven synchronously with the machine, electrical switching means intermittently actuated by said dog, and a timer switch in circuit with said switching means to insure energization thereof only at a predetermined phase in the cycles of operation of the machine including circuit connections to render said timer switch ineffectual upon energization of said switching means, whereby the tape jumping operation may occur over an interval of the order of four cycles of operation of the machine as determined solely by the dura-

tion of coaction between said dog and said switching means.

4. The combination with a continuous slide fastener forming machine having apparatus for successively attaching scoops onto a tape, of means for producing blank spaces of predetermined lengths comprising an instrumentality for rapidly advancing the tape by amounts corresponding to the lengths of said blank spaces embodying feed rollers for the tape, an element coupled to said feed rollers and a solenoid having a plunger for actuating said element to advance said rollers to advance the tape, and means for controlling the operation of said instrumentality in synchronism with the continuous operation of the machine comprising a timing component with a dog driven synchronously with the machine, electrical switching means actuated by said dog for operating said element, and a timer switch in circuit with said switching means to insure energization thereof only at a predetermined phase in the cycles of operation of the machine including circuit connections to render said timer switch ineffectual upon energization of said switching means whereby the tape advancing operation may occur over an interval of several cycles of operation of the machine as determined solely by the duration of coaction between said dog and said switching means.

5. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes, an instrumentality for jumping the tape by amounts corresponding to the lengths of said blank spaces, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing component driven synchronously with the machine, electrical switching means intermittently actuated by said timing component including a first switch arranged for operating said device to arrest the feeding of the metal strip, and a second switch arranged for operating said instrumentality for jumping the tape, said second switch being actuated subsequently to the actuation of said first switch whereby the metal strip is held stationary during the jumping of the tape.

6. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes, an instrumentality for jumping the tape by amounts corresponding to the lengths of said blank spaces, and means for controlling the operation of said device and said instrumentality in synchronization with the continuous operation of the machine comprising a timing component driven synchronously with the machine, electrical switching means intermittently actuated by said timing component including a first switch arranged for operating said device to arrest the feeding of the metal strip, and a second switch arranged for operating said instrumentality for jumping the tape, said second switch being actuated subsequently to the actuation of said first switch whereby the metal strip is held stationary during the jumping of the tape, and a timer switch in circuit with said second solenoid to insure energization thereof only at a predetermined phase in the cycles of operation of the machine.

7. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes, an instrumentality for jumping the tape by amounts corresponding to the lengths of said blank spaces, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing component driven synchronously with the machine, electrical switching means intermittently actuated by said timing component including a first switch arranged for operating said device to arrest the feeding of the metal strip, and a second switch arranged for operating said instrumentality for jumping the tape, said second switch being actuated subsequently to the actuation of said first switch whereby the metal strip is held stationary during the jumping of the tape, and a timer switch in circuit with said second solenoid to insure energization thereof only at a predetermined phase in the cycles of operation of the machine, whereby the tape jumping operation may occur over an interval of several cycles of operation of the machine, as determined solely by the duration of coaction between said timing component and said switching means.

8. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes, an instrumentality for jumping the tape by amounts corresponding to the lengths of said blank spaces, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing component having a dog driven synchronously with the machine, electrical switching means intermittently actuated by the dog of said timing component, including a first switch arranged for operating said device to arrest the feeding of the metal strip, and a second switch arranged for operating said instrumentality for jumping the tape, said second switch being actuated subsequently to the actuation of said first switch whereby the metal strip is held stationary during the jumping of the tape, whereby the tape jumping operation may occur over an interval of the order of four cycles of operation of the ma-

chine, as determined solely by the duration of coaction between said dog and said switching means.

9. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined lengths between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes embodying a latching member and a first solenoid for actuating said member, an instrumentality or jumping the tape by amounts corresponding to the lengths of said blank spaces embodying feed rollers for the tape, an element coupled to said feed rollers and a second solenoid having a plunger for actuating said element to advance said rollers to jump the tape, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing component driven synchronously with the machine, electrical switching means actuated by said component including a first switch in circuit with said first solenoid for arresting the feeding of the metal strip, and a second switch in circuit with said second solenoid for effecting the jumping of the tape.

10. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined lengths between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes embodying a latching member and a first solenoid for actuating said member, an instrumentality for jumping the tape by amounts corresponding to the lengths of said blank spaces embodying feed rollers for the tape, an element coupled to said feed rollers and a second solenoid having a plunger for actuating said element to advance said roller to jump the tape, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing component driven synchronously with the machine, electrical switching means actuated by said component including a first switch in circuit with said first solenoid for arresting the feeding of the metal strip, and a second switch in circuit with said second solenoid for effecting the jumping of the tape, said second switch being interlocked for actuation subsequently to the actuation of said first switch, whereby the metal strip is held stationary during the jumping of the tape.

11. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined lengths between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes embodying a latching member, and a first solenoid for actuating said member, an instrumentality for jumping the tape by amounts corresponding to the lengths of said blank spaces embodying feed rollers for the tape, an element coupled to said feed rollers and a second solenoid having a plunger for actuating said element to advance said rollers to jump the tape, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing component driven synchronously with the machine, electrical switching means actuated by said component including a first switch in circuit with said first solenoid for arresting the feeding of the metal strip, and a second switch in circuit with said second solenoid for effecting the jumping of the tape, and a timer switch in circuit with said second solenoid to insure energization thereof only at a predetermined phase in the cycles of operation of the machine.

12. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes embodying a latching member and a first solenoid for actuating said member, an instrumentality for jumping the tape by amounts corresponding to the amount of said blank spaces embodying feed rollers for the tape, a pull-cord coupled to said feed rollers and a second solenoid having a plunger for actuating said pull-cord to advance said rollers to jump the tape, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing chain with a dog driven synchronously with the machine and electrical switching means intermittently actuated by said dog including a first switch in circuit with said first solenoid for operating said latching member, and a second switch in circuit with said second solenoid for operating said pull-cord, said second switch being arranged for actuation subsequently to the actuation of said first switch, whereby the metal strip is held stationary during the jumping of the tape.

13. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes embodying a latching member and a first solenoid for actuating said member, an instrumentality for jumping the tape by amounts corresponding to the amount of said blank spaces embodying feed rollers for the tape, a pull-cord coupled to said feed rollers and a second solenoid having a plunger for actuating said pull-cord to advance said rollers to jump the tape and a damping element connected with said pull-cord for mechanically smoothing the tape jumping operation, and means for controlling the operation of said device and said instrumentality in synchronism with the continu-

ous operation of the machine comprising a timing chain with a dog driven synchronously with the machine and electrical switching means intermittently actuated by said dog including a first switch in circuit with said first solenoid for operating said latching member, and a second switch in circuit with said second solenoid for operating said pull-cord, said second switch being arranged for actuation subsequently to the actuation of said first switch whereby the metal strip is held stationary during the jumping of the tape.

14. The combination with a continuous slide fastener forming machine having mechanism for intermittently feeding a continuous metal strip and apparatus for shaping individual scoops from the metal strip and successively attaching the scoops onto a tape, of means for producing blank spaces of predetermined amounts between groups of scoops on the tape comprising a device for positively arresting the feeding of the metal strip for a predetermined integral number of feeding strokes embodying a latching member and a first solenoid for actuating said member, an instrumentality for jumping the tape by amounts corresponding to the amount of said blank spaces embodying feed rollers for the tape, a pull-cord coupled to said feed rollers and a second solenoid having a plunger for actuating said pull-cord to advance said rollers to jump the tape and a damping element connected with said pull-cord for mechanically smoothing the tape jumping operation, and means for controlling the operation of said device and said instrumentality in synchronism with the continuous operation of the machine comprising a timing chain with a dog driven synchronously with the machine and electrical switching means intermittently actuated by said dog including a first switch in circuit with said first solenoid for operating said latching member, and a second switch in circuit with said second solenoid for operating said pull-cord, said second switch being arranged for actuation subsequently to the actuation of said first switch whereby the metal strip is held stationary during the jumping of the tape, and a timer switch in circuit with said second solenoid to insure energization thereof only at a predetermined phase in the cycles of operation of the machine including circuit connections to render said timer switch ineffectual upon energization of said second solenoid whereby the tape jumping operation may occur over an interval of several cycles of operation of the machine.

WALTER A. BEHRENS.

DEFENDANT'S EXHIBIT "BT"

R. C. Legat Patent No. 2,116,726

Filed June 19, 1937 Patented May 10, 1938

METHOD OF MAKING FASTENER UNITS

Filed June 19, 1937 2 Sheets-Sheet 1

Fig. 2

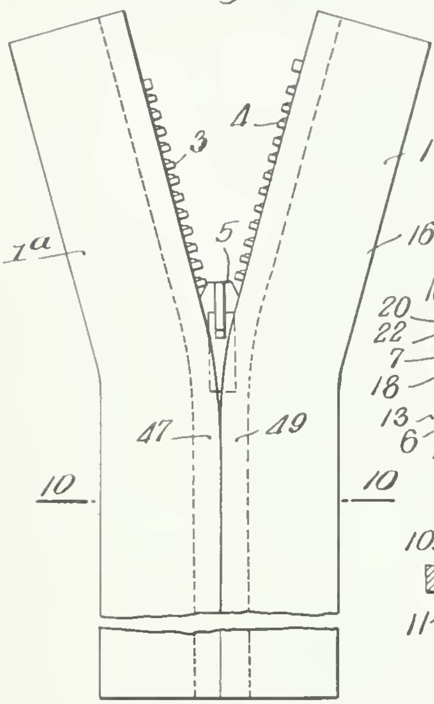


Fig. 1

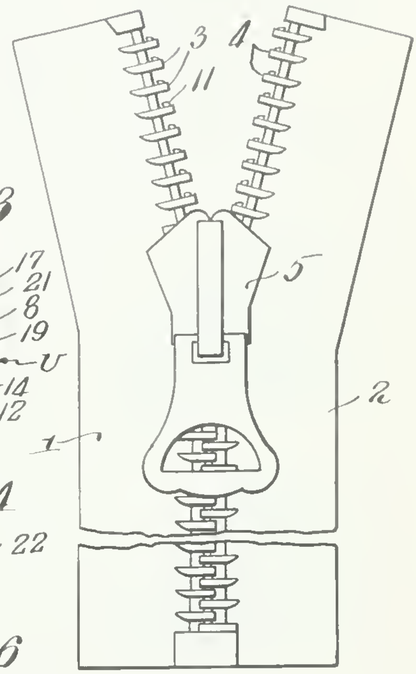


Fig. 3

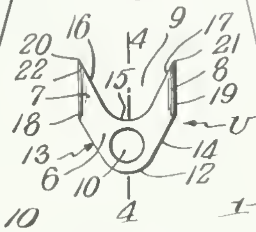


Fig. 4

Fig. 6

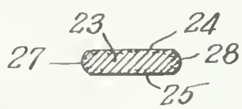


Fig. 5

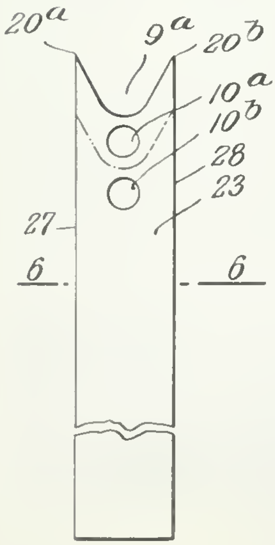
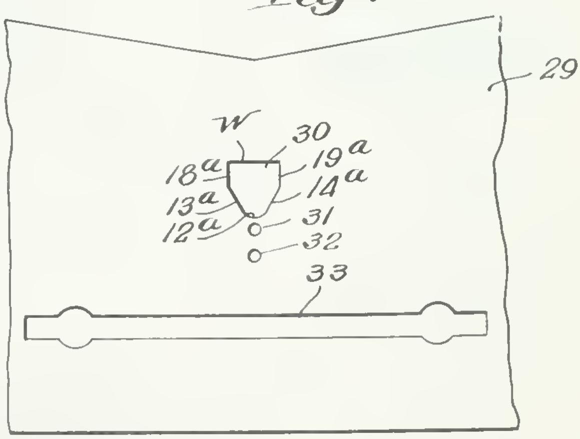


Fig. 7



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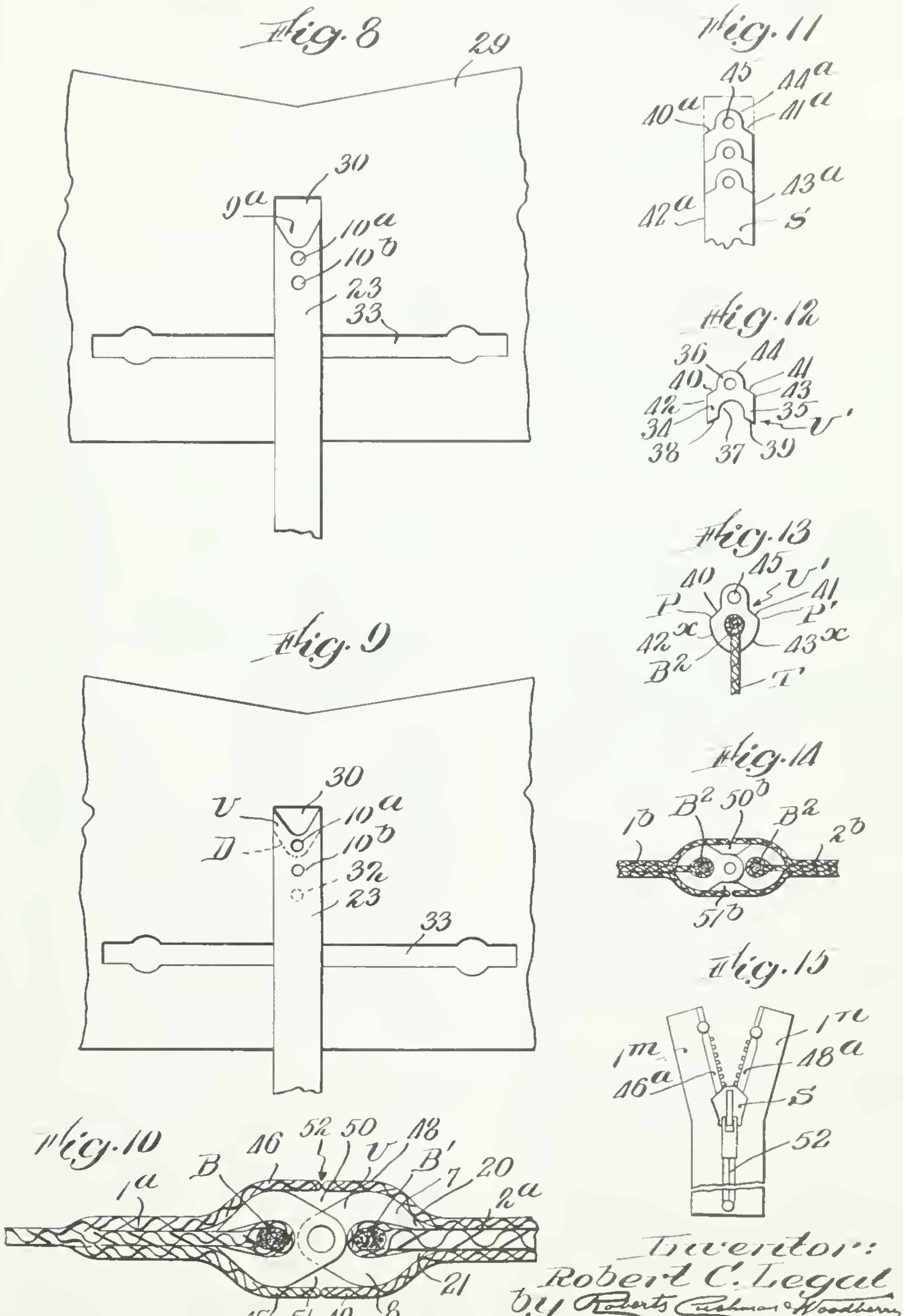
METHOD OF MAKING FASTENER UNITS

Filed June 19, 1937 2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,116,726

METHOD OF MAKING FASTENER UNITS

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Application June 19, 1937, Serial No. 149,110

9 Claims. (Cl. 29—148)

This invention pertains to slide fasteners and relates more particularly to a novel method of making fastener units, the present application being a continuation-in-part of my copending application for Letters Patent Serial No. 62,065, filed February 3, 1936 upon which was granted Patent No. 2,097,099, October 23, 1937. A principal object of the present invention is to provide a novel method of making fastener units from sheet metal in such a way as to avoid waste.

A further object is to provide a method of making a fastener unit of such shape and dimensions that the amount of metal in the completed fastener is reduced substantially to a minimum; to provide a method of making a unit having attaching legs or jaws which taper inwardly toward the plane of the stringer thereby eliminating square corners and providing a neat and pleasing appearance; to provide a method of making fastener units such that the completed fastener will be flexible, light in weight, of substantially minimum front-to-rear thickness, and acceptable for use in garments of substantially all types; to provide a method of making a fastener unit especially useful in the covered type of fastener (having cover flaps for concealing the units) whereby such a covered fastener will not be unduly bulky, as compared with the uncovered fastener; and to provide a method of making a fastener unit having attaching jaws whose outer surfaces are smoothly finished and of wear-resistant character well suited to receive the thrust of the cam surfaces of the actuating slider.

Other objects and advantages of the invention will be made manifest in the following more detailed description and by reference to the accompanying drawings, wherein

Fig. 1 is a fragmentary front elevation of a fastener, embodying units made in accordance with the present invention;

Fig. 2 is a view similar to Fig. 1 but illustrating a covered fastener;

Fig. 3 is a view, to large scale, showing the under side of a fastener unit made in accordance with the present invention but before it has been applied to the stringer or flexible support;

Fig. 4 is a section substantially on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary plan view, to large scale, showing a strip or ribbon of metal having a recess in its end portion such as results from cutting from the strip a fastener unit like that of Fig. 3;

Fig. 6 is a section on the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary plan view, to large scale, of a bottom die member useful in making fastener units from a strip such as that of Figs. 5 and 6;

Fig. 8 is a view, generally similar to Fig. 7, showing a metal strip or ribbon, like that of Fig. 5, disposed upon the bottom die member and as it appears at the completion of the working stroke of the cooperating punch, and after the latter has been retracted;

Fig. 9 is a view similar to Fig. 8, but showing the ribbon as having been advanced in readiness for the next down stroke of the punch die;

Fig. 10 is a diagrammatic transverse section, to large scale, through a covered fastener, such as that of Fig. 2, employing units of a type herein specifically disclosed, showing the units as anchored to the edge beads of the stringers or flexible supports;

Fig. 11 is a fragmentary plan view of a length of metallic ribbon illustrating an alternative mode of procedure, in accordance with this invention, whereby fastener units of somewhat different shape are produced without waste from the ribbon or strip;

Fig. 12 is a plan view of one of the units produced in accordance with the method illustrated in Fig. 11;

Fig. 13 is a transverse section through a stringer or flexible support, showing one of the units of Fig. 12 secured to the support;

Fig. 14 is a view generally similar to Fig. 10, but to smaller scale, illustrating a covered fastener employing units such as that of Fig. 12; and

Fig. 15 is a view generally similar to Fig. 2, but showing a covered fastener of a slightly different type.

Referring to the drawings, the numerals 1 and 2 (Fig. 1) designate a pair of flexible supports or stringers, each preferably provided with an edge bead and having series 3 and 4 respectively of fastener units fixed to its beaded edge. The fastener comprising these tapes is, as usual, furnished with bottom and top stops and with an actuating slider 5. The units of the series 3 and 4 are all substantially alike, the outer or projecting end of each unit being furnished with a socket in one face and with a corresponding projecting pin 11 at its opposite face. These units, before attachment to the stringer, and in accordance with a preferred embodiment of the invention, are of the general shape of the unit U, as shown in Figs. 3 and 4. The unattached unit comprises the head portion 6 and a pair of spaced anchoring jaws or legs 7 and 8, separated by a recess 9 at the inner end of the unit. The head portion of each unit, as above referred to, is furnished with a socket opening 10 (Fig. 4) in one face and with a projecting pin 11 at its opposite face.

The outer end of the head portion of the unit is rounded or curved as shown at 12 (Fig. 3) and the lateral edges 13 and 14 of this head portion preferably are substantially straight and diverge from each other, and in the unattached unit form tangents to the curved portion 12. Likewise the recess 9 of the unattached unit has a curved inner wall 15, the curvature of which is substantially identical with the curvature of the end portion 12 of the head of the unit, and the side walls 16 and 17 of the recess are substantially straight and tangent to the curved inner wall 15, being substantially parallel respectively to the lateral outer surfaces 13 and 14 of the head portion, and intersect the outer, substantially parallel surfaces 18 and 19 of the attaching jaws in sharply acute angles at the points 20 and 21, respectively. As a result of the method of making these units now about to be described, the extreme ends of the jaws 7 and 8 are usually somewhat rounded off, as shown at 22, (Fig. 4) so that the tips of the jaws taper both horizontally and vertically.

In accordance with the preferred method of making these units U, a length of metal ribbon 23, of a character suitable for the making of fastener units of this type, preferably such as is not easily corroded by moisture, is first prepared, such ribbon being of a transverse width substantially equal to the distance between the outer edges 18 and 19 of the unit before the latter is attached to its stringer, this distance substantially equaling the maximum front-to-rear thickness of the unit after its attachment to the stringer.

While this metal ribbon 23 may be made merely by shearing sheet metal to the desired width, it is preferred to prepare this ribbon by an operation including drawing or rolling such as to provide smooth, compact outer surfaces, free from burrs and requiring no further finishing operation. Thus, as indicated in Fig. 6, the ribbon 23 has the substantially flat and smooth upper and lower surfaces 24 and 25 and the lateral edges 27 and 28, such edges preferably being slightly rounded. If this ribbon be produced by a cold drawing or cold rolling operation, the metal closely adjacent to the outer surfaces will be more dense than at the central portion of the ribbon, usually with the fiber running lengthwise of the ribbon, and such outer part of the ribbon, for example, the edge portions 27 and 28, will thus be more wear resistant than though the ribbon were produced merely by shearing sheet metal. However, while it is preferred to make the ribbon by drawing or rolling operations, or at least to finish its outer surfaces by rolling or compression, the invention is not necessarily limited to the use of ribbon prepared in this way.

For the performance of the method of the present invention it is preferred to provide a punch and die apparatus comprising, for example, the lower die member 29 (Fig. 7) having an opening 30 provided with a curved wall 12^a corresponding in curvature and dimensions to the curved end 12 of the desired unit. This opening 30 is also provided with substantially straight divergent walls 13^a and 14^a corresponding to the edges 13 and 14 of the unit and with substantially parallel walls 18^a and 19^a corresponding to the edges 18 and 19 of the attaching jaws of the unit and spaced apart a distance substantially equal to the width of the strip 23. The wall W of this opening 30 is substantially straight and perpendicular to the walls 18^a and 19^a and is spaced from the most distant part of the curved wall 12^a a distance equal to the maximum length of the unit to be formed. The die 29 is also furnished with one, but preferably two circular openings 31 and 32 corresponding in dimensions to the projection 11 which is formed on each unit, the centers of the openings 31 and 32 being spaced apart a distance substantially equal to the distance between the curved walls 12 and 15 of the unit.

The punch (not shown), which cooperates with the die 29, is provided with a part which substantially fits the opening 30 so as to cooperate with the edges of the opening 30 in forming a shear cut and is also furnished with a pair of plungers adapted to cup the metal down into the openings 31 and 32 but without shearing through the metal. Preferably die 29 is furnished with a slot 33 for the reception of a stripper device (not shown) for lifting the metal from the die 29 after each punching operation. Since this stripper forms no essential part of the present invention, it is not herein illustrated.

In preparation for the operation of making the units U by the use of the punch and die, the extreme end of the metal ribbon or strip 23 is first shaped as shown, for example, at 9^a in Fig. 5, so as to have a recess corresponding to the recess 9 of the desired unit, the ribbon terminating at its opposite edges in acute points 20^a and 20^b. This shaping of the extreme end of the ribbon may be done in any desired manner, although ordinarily by the use of the punch and die, the first operation of the punch and die producing a small piece of waste metal corresponding in shape to the recess 9^a, this being the only waste which is produced during the operation.

Having shaped the end of the ribbon as just described, for example by the use of the punch and die, and assuming that the latter method has been used, the ribbon, at the end of this first operation, will occupy the position shown in Fig. 8, the punch having produced the two socket openings or depressions 10^a and 10^b in the ribbon outside of the limits of the recess 9^a. The punch having now been retracted, the ribbon is advanced to the position shown in Fig. 9, the projection which was formed in the die opening 31 now overlying the edge of the opening 30, while the projection which was initially formed in the die opening 32 now seats in the opening 31 of the die 29 and thus serves accurately to space the ribbon with reference to the opening 30 preparatory to the next descent of the punch. The punch now moves downwardly into the opening 30 and punches out a complete unit U, forming a severing cut or incision along the dotted line D in Fig. 9 and at the same time again cupping the metal down into the opening 32 of the die. It may be noted that the incision at the line D extends completely across the ribbon 23 from one lateral edge to the other of the latter and that this incision intersects the lateral edges in acute angles which define the extreme ends 20 and 21 of the jaw members of the next unit to be cut. The punch is now lifted, the ribbon advanced forwardly one step, and the punch again caused to descend, thus at each stroke of the punch cutting off a complete unit without producing any appreciable waste whatsoever after that resulting from the initial formation of recess 9^a.

Since the metal at the extreme ends of the attaching jaws is very thin, the friction of the punch in shearing the metal tends to draw or compress these extreme ends so that they assume some such form as indicated at 22 in Fig. 4, the tips of the jaws thus tapering both vertically and horizontally.

Having prepared the units U, these units may be secured to the beaded edge of the stringer by any suitable mechanism such as has commonly been used in this art for uniting independent units to stringer tapes. In Fig. 10, the units U are shown as having been attached to tapes 1^a and 2^a having the edge beads B and B' respectively. Each unit is so disposed that its spaced jaws 7 and 8 straddle the edge bead, and then the jaws 7 and 8 are subjected to lateral pressure tending to cause the metal to flow, thereby bending the jaws so that their tips 20 and 21 approach each other, thus firmly clamping the edge bead between them. When the unit has been finally fixed to the stringer, the tips 20 and 21 lie substantially in the planes of the opposite faces of the stringer tape or may be somewhat indented into the tape, since the pressure tends to compress the tape where it is engaged between the jaws.

The curved inner surface 15 of the recess is so located that when the unit is anchored in place, the unit is of maximum front-to-rear thickness substantially in the vertical front-to-rear plane of the edge bead, the outer surfaces of the attaching jaws now being smoothly curved and the unit tapering in thickness from this point of maximum thickness in both directions, that is to say, toward its outer curved end, and toward its inner end at which the tips of the jaws merge with the surfaces of the tape.

By reason of the fact that the outer curved end of the unit is relatively narrow as compared with the maximum thickness of the unit,—shallow longitudinal channels 50 and 51 are formed at the front and rear of the fastener when the units of the opposite series are interengaged. As illustrated in Fig. 10, the stringer tapes 1^a and 2^a are provided with covering flaps 48 and 47, and 48 and 49, respectively, which, as illustrated, are woven integrally with the tapes 1^a and 2^a, respectively. These covering flaps are designed substantially to cover the units when the fastener is closed and the edges of the flaps at the same side of the fastener substantially meet along a line such as indicated at 52 (Fig. 10). In such an arrangement, the channels 50 and 51 are of assistance in helping to keep the free edges of the flaps 46 and 48 in substantial alignment,—particularly in that type of fastener shown in Fig. 15 in which the slider channels receive the flaps 46 and 48 so that the slider, as it moves up and down, irons the flaps back into the channels 50 and 51.

A fastener of this general type is illustrated in Fig. 15 wherein the stringers 1^m and 1^n are shown as provided with the cover flaps 46^a and 48^a, respectively, and in which the slider S overrides the flaps and, in drawing the opposed series of units together, pulls the free edges of the flaps into substantial engagement along the line 52. If desired, in such an arrangement as that shown in Fig. 15, the flaps 46^a and 48^a may initially consist of a single piece of textile or other sheet material which is secured to the respective stringers so as to extend continuously across the united series of fasteners and which is then cut by means of a knife or other suitable instrument, along the line 52, thereby producing edges which are the exact counterpart of each other and thus capable of covering the units completely. However, these edges are raw edges and it is usually preferred, as a commercial matter, to make the flaps 47 and 49 as shown for example in Fig. 10, so that they have selvage edges which will withstand the wear of movement of the slider.

In Fig. 2 a different embodiment of covered fastener is illustrated, corresponding more exactly to the arrangement of Fig. 10, the slider channels of the slider 5 (Fig. 2) receiving the series 3 and 4 of the fastener units but not receiving the edges of the covering flaps 47 and 49.

As illustrated in Figs. 11 to 14 inclusive, the invention also contemplates the provision of fastener units of somewhat different shape from those shown in Figs. 3 and 4, for example, although, like the latter, capable of being made without waste of material. Thus, referring to Fig. 12 the unattached unit U' comprises the attaching legs or jaws 34 and 35 and the head portion 36. The attaching or anchoring jaws or legs 34 and 35 are spaced apart by a recess 37, the latter preferably having substantially parallel side walls and an arcuate inner end wall. The free ends of these legs or jaws preferably are inclined, as indicated at 38 and 39, respectively, so as to converge toward the inner end of the recess,—these ends 38 and 39 hereinafter being referred to as the "inner" ends of the unit, while the head 36 is referred to as the "outer" end of the unit. This head 36 is of substantially less width than the main body of the unit, preferably being of an external width not substantially greater than the thickness of the edge bead to which the unit is to be attached,—the head being in fact of substantially the same size and shape as the recess 37. At each side of the head the unit body terminates in inclined shoulders 40 and 41, respectively, which converge toward the outer end of the unit, the outer edges 42 and 43 of the jaws of the unattached unit being substantially parallel, while the end surface 44 of the head is of curved contour. The shoulders 40 and 41 in the unattached unit are substantially parallel to the end surfaces 38 and 39, respectively, of the legs.

This unit, like that of Figs. 3 and 4, may be made very economically and without any waste of material, as indicated diagrammatically in Fig. 11. In thus manufacturing the units, a ribbon or strip S of sheet metal, preferably of the type indicated in Fig. 6 as above described, is provided, such strip having the substantially parallel edges 42^a and 43^a spaced apart substantially the same distance as the outer surfaces 42 and 43 of the unattached unit of Fig. 12. This ribbon or strip S is advanced by successive steps into the field of action of a cooperating die and punch suitably shaped, and which operate in substantially the same manner as the die and punch above referred to, to cut off successive units from the end of the strip. At each operation of the punch an incision is made which extends completely across the width of the strip, such incision comprising the curved central portion 44^a (Fig. 11) and the lateral, divergent straight portions 40^a and 41^a. Each incision completely severs the strip and each incision at the same time forms the inner end of one unit and the outer end of the next unit. Simultaneously with, or before or after the actuation of the cutting punch, the material of the strip is subjected to the operation of a cupping element which forms a projecting pin 45 on one surface of the head and a corresponding socket (not shown) in the opposite face of the head.

It will be noted that, as a result of this mode of procedure, the outer edges 42 and 43 of the unit are unchanged portions of the original edges 42^a and 43^a of the strip S,—the head 36 of each unit representing that part of the original material which is removed in making the recess 37 of the next unit, while the shoulders 40 and 41 of one unit correspond to the inclined ends 38 and 39 of the jaws of the next unit. Thus no waste whatsoever is produced.

After the units have been formed to the shape shown in Fig. 12, they are attached to the edge bead of the stringer by means of any suitable mechanism, either one-by-one in succession, or in groups in accordance with the type of mechanism employed. If preferred, they may be subjected to some suitable finishing operation before attaching them to the stringer, although this is not necessary in all cases, since the outer edges 42 and 43 at least of the attaching jaws may be made very smooth and with a finished surface in accordance with the above mode of producing the units, providing the ribbon has smooth edges to start with.

In attaching the unit to the edge bead of the stringer, pressure is applied to the spaced legs or jaws 34 and 35 so that the metal is bent and caused to flow until the parts take substantially the position indicated in Fig. 13. The jaws 34 and 35 are thus caused to embrace the edge bead B^2 of the stringer T, and in thus compressing the unit the end surfaces 38 and 39 of the jaws are brought very nearly into parallel relation and into contact with the opposite faces of the stringer tape, while the outer edges of the jaws are curved as indicated at 42^x and 43^x and caused to assume such a relative position that they diverge from their inner or free ends toward the mid-portion of the unit. Thus in the attached unit the points P and P′, which substantially represent the junctions of the surfaces 40 and 42^x and of the surfaces 41 and 43^x, respectively, define the thickest part of the unit. In fact the stringer-engaging portion of the unit, in plan view when attached, is somewhat suggestive of a circular triangle or a conventional heart-shape.

It may be noted that the point of greatest front-to-rear thickness lies substantially in the front-to-rear plane of the points P—P′ and that this plane is closely adjacent to the front-to-rear plane of the axis of the bead and that the unit decreases in thickness from this plane P—P′ toward both its inner and outer ends.

As illustrated in Fig. 14, when units U′ of this latter type are attached to the beaded edges B^2 of stringer tapes 1^b and 2^b, respectively, longitudinal channels 50^b and 51^b are formed at the front and rear of the closed fastener and such channels are of somewhat greater depth and dimensions than the channels 50 and 51 which are formed by the use of the units U above described. Thus units U′, such as shown in Figs. 11 to 14, may sometimes be preferred in making covered fasteners of the type shown in Fig. 15 wherein the slider overrides the covering flaps and is intended to iron the flaps backwardly so as to cause them to lie flat during the use of the fastener.

While certain desirable embodiments of the invention have been described by way of example, it is to be understood that the invention is not necessarily limited to these precise constructions or modes of procedure but is to be regarded as broadly inclusive of any and all equivalents, either in materials or apparatus employed or of process steps, as well as any other sequence of process steps than herein specifically described but which produces the same ultimate result.

I claim:

1. Method of making fastener units for use in slide-actuated fasteners, which comprises as steps providing a length of metal ribbon of a width substantially equaling the desired maximum width of the unit, advancing said ribbon endwise step-by-step into the field of action of cutting and forming devices, and at each successive step severing the ribbon by a single incision which extends completely across the width of the ribbon, said incision including a curved central portion and divergent, substantially straight side portions, the latter intersecting the respective edges of the ribbon in acute angles.

2. Method of making fastener units for use in slide-actuated fasteners, which comprises as steps providing a length of metal ribbon of a width substantially equaling the desired maximum width of the unit, advancing said ribbon endwise step-by-step into the field of cutting and forming devices, and at each successive step severing the ribbon by a single incision which extends completely across the width of the ribbon, said incision having a contour substantially corresponding to the desired shape of the outer end portion of the unit and meeting the respective edges of the ribbon in acute angles.

3. That method of making fastener units for use in slide-actuated fasteners, which comprises as steps providing a length of metal ribbon of a width substantially equal to that of the desired maximum transverse width of the unit, cutting said ribbon transversely, the incision extending across the entire width of the ribbon and being of a contour substantially corresponding to the desired finished shape of the outer end portion of the unit and meeting the respective edges of the ribbon in acute angles which define the extreme inner ends of the attaching jaw portions of the unit, and making a second incision identical in shape with the first but spaced longitudinally of the ribbon a distance equaling the distance by which the outer end of the unit, when attached, shall project beyond the edge of its flexible support.

4. That method of making fastener units for use in slide-actuated fasteners, which comprises as steps providing a length of metal ribbon of a width substantially equal to that of the desired maximum transverse width of the unit, shaping the end of the ribbon to a contour substantially corresponding to the desired shape of the outer end portion of the unit and thereafter making successive spaced, like incisions, each extending across the entire width of the ribbon and each of a contour like that of the shaped end of the ribbon and intersecting the respective edges of the ribbon in acute angles which define the extreme inner ends of the attaching jaws of each successive unit, the first incision being spaced from said shaped end of the ribbon and successive incisions being spaced from the next each by a distance equaling the distance by which the outer end of the unit, when attached, shall project beyond the edge of its flexible support.

5. Method of making like fastener units in succession, each unit having an outer or head portion having a curved end contour and provided with a pin and socket, and a pair of spaced attaching jaws separated by a recess, the inner part of the recess of the unattached unit being of substantially the same contour and dimensions as the head portion of the unit, said method comprising as steps providing a length of metal ribbon of a width substantially equal to the maxi-

mum transverse width of the desired unit, said ribbon having edge portions which are hard, dense and wear resistant, cutting units in succession without waste from said ribbon, each by a single incision which extends completely across the width of the ribbon, each incision intersecting the respective edges of the ribbon at points defining the extreme ends of the attaching jaws of the unit, successive incisions being so spaced longitudinally of the ribbon that the outer surfaces of the jaws of each unit consist of unchanged portions of the respective edges of the ribbon.

6. Method of making fastener units for use in slide-actuated fasteners which comprises as steps providing a length of metal ribbon having smooth and dense edges such as result from cold working the metal, advancing the ribbon endwise into the field of action of cutting dies, incising the metal by a cut which extends from one edge to the other and of a contour such as to form a recess in the end of the ribbon, said recess having an arcuate inner end and divergent walls which meet the edges of the ribbon in acute angles, cupping the material of the ribbon at a point inwardly of the end of the recess to provide a socket in one face and a pin projecting from the opposite face, again advancing the ribbon relatively to the dies and again actuating the dies to form a second cut, spaced longitudinally of the ribbon from the first, but identical in contour with the first cut, thereby to sever a completed unit from the length of ribbon, said unit having jaw portions which taper toward their free ends.

7. Method of making fastener units for use in slide-actuated fasteners which comprises as steps cutting from a length of sheet material a piece shaped to constitute spaced attaching jaws separated by a recess and which taper acutely toward their free ends, and a head portion of substantially the same contour and dimensions as the recess, and cupping the material of the head to form a socket in one face and a pin projecting from the opposite face.

8. Method of making fastener units for use in slide-actuated fasteners which comprises as steps cutting from a length of metal ribbon a piece shaped to constitute spaced attaching jaws whose outer edges are unchanged portions of the respective edges of the ribbon and which taper acutely toward their free ends, said jaws being separated by a recess having divergent side walls merging with an arcuate inner wall, and a head portion of substantially the same external contour and dimensions as the recess, and cupping the material of the head to form a socket in one face and a pin projecting from the opposite face.

9. Method of making fastener units for use in slide-actuated fasteners which comprises as steps cutting substantially like pieces in succession from a length of metal ribbon in such a way that each piece comprises spaced attaching jaws whose outer edges are unchanged portions of the respective edges of the ribbon, and which taper acutely toward their free ends, said jaws being separated by a recess having divergent walls which meet the edges of the ribbon at acute angles, and a head portion substantially identical in contour and dimensions with the recess, and cupping the material of the head to form a socket in one face thereof and a pin projecting from the opposite face.

ROBERT C. LEGAT.

DEFENDANT'S EXHIBIT "BU"

F. Ulrich Patent No. 2,302,075

Filed Mar. 28, 1939 Patented Nov. 17, 1942

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SLIDE FASTENER MANUFACTURE

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FIG. 1.

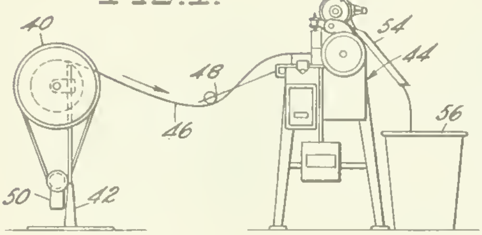


FIG. 2.

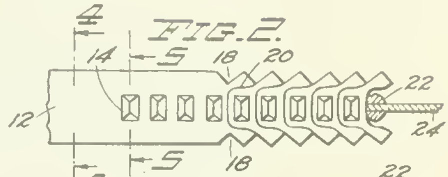


FIG. 3.

FIG. 4.

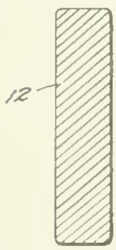


FIG. 5.

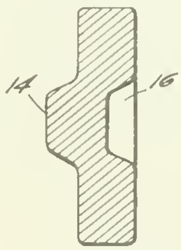


FIG. 6.

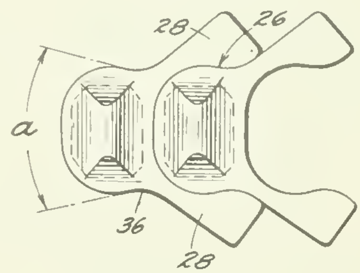


FIG. 7.

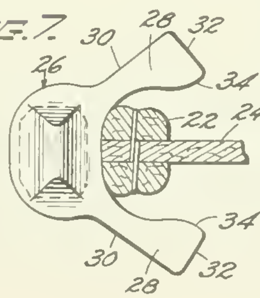
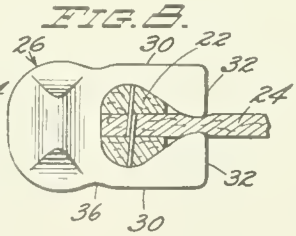


FIG. 8.



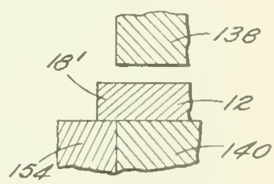


FIG. 9.

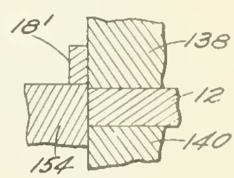


FIG. 10.

FIG. 11.

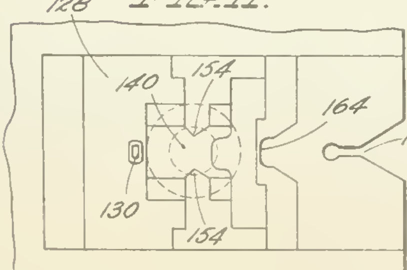


FIG. 12.

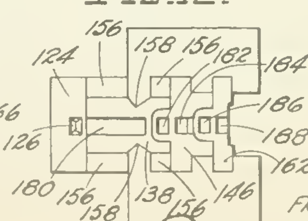


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FIG. 13.

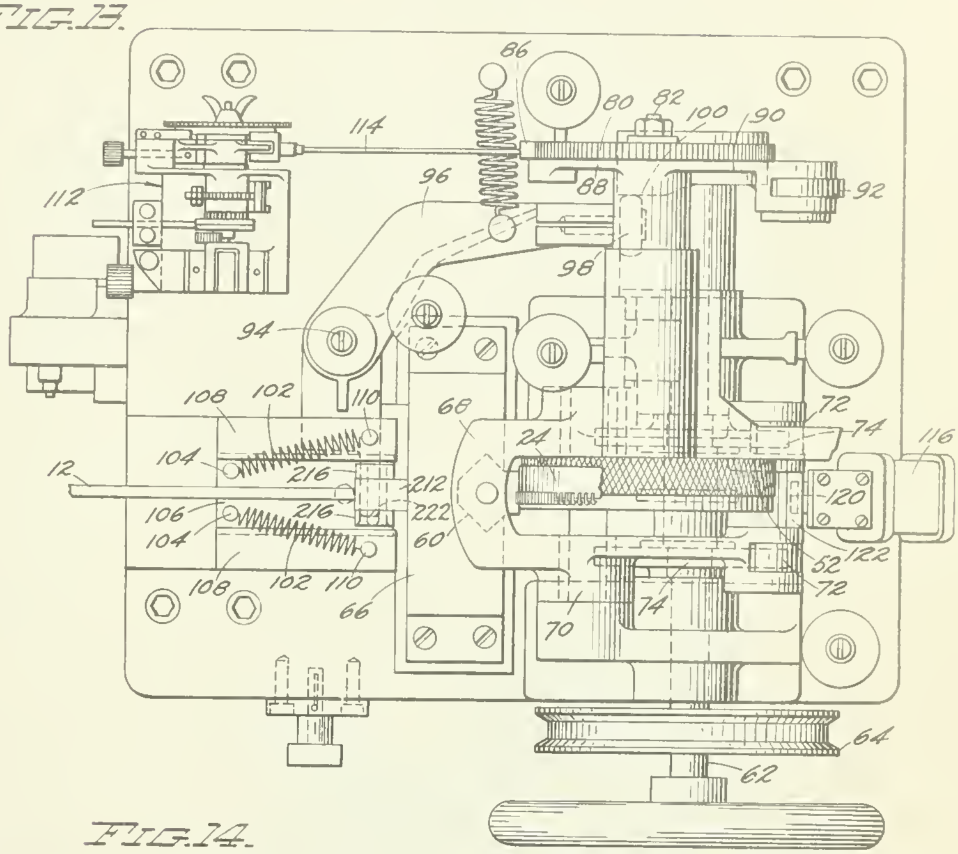


FIG. 14.

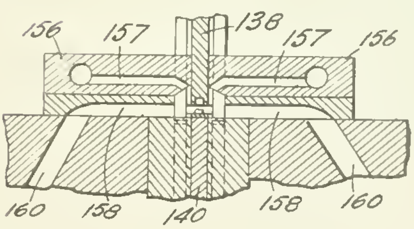
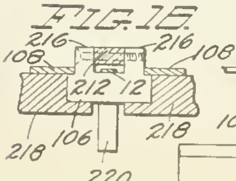


FIG. 16.



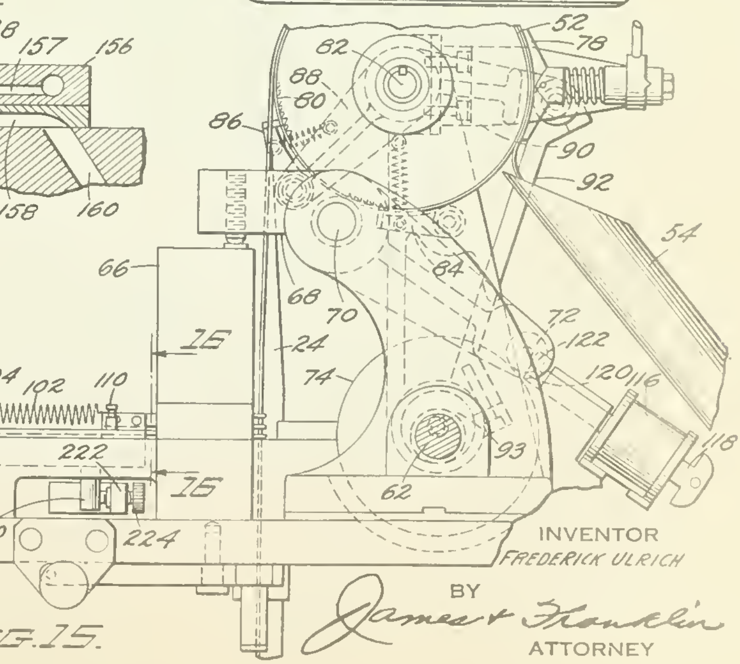


FIG. 15.

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FIG. 18.

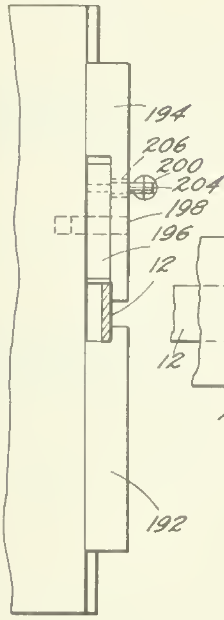

FIG. 17.

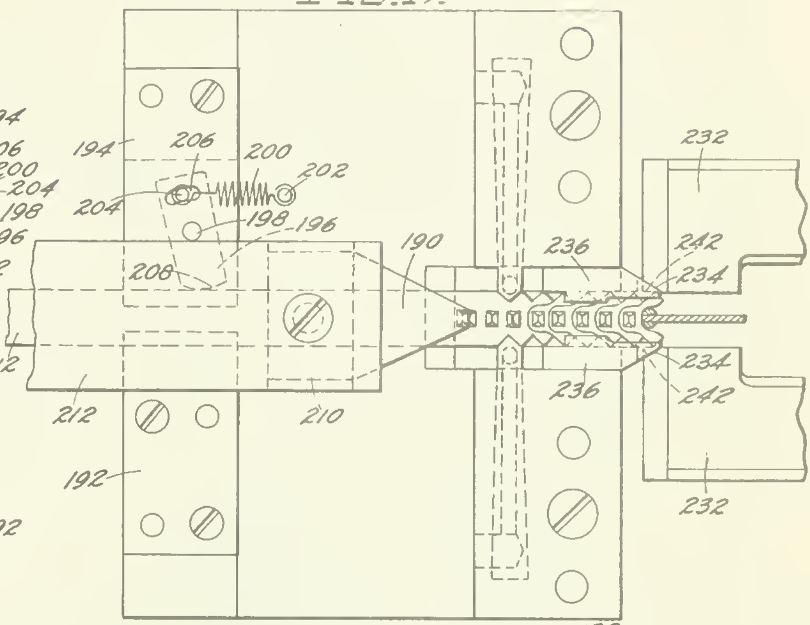

FIG. 19.

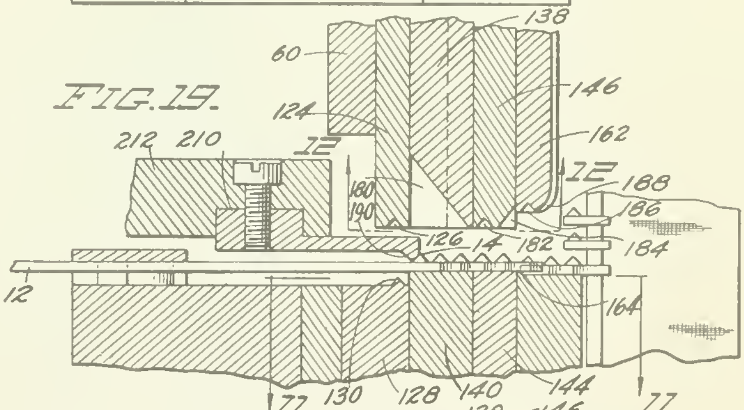

FIG. 20.

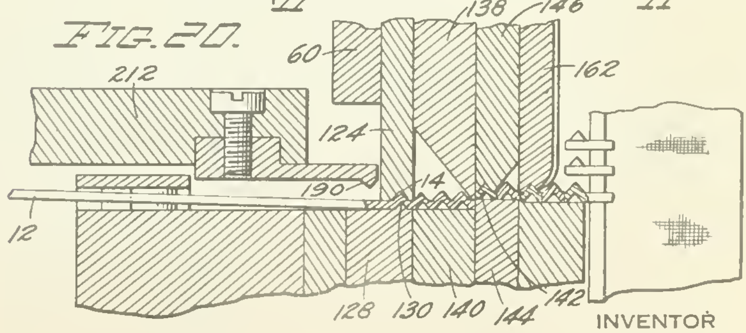

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FIG. 21.

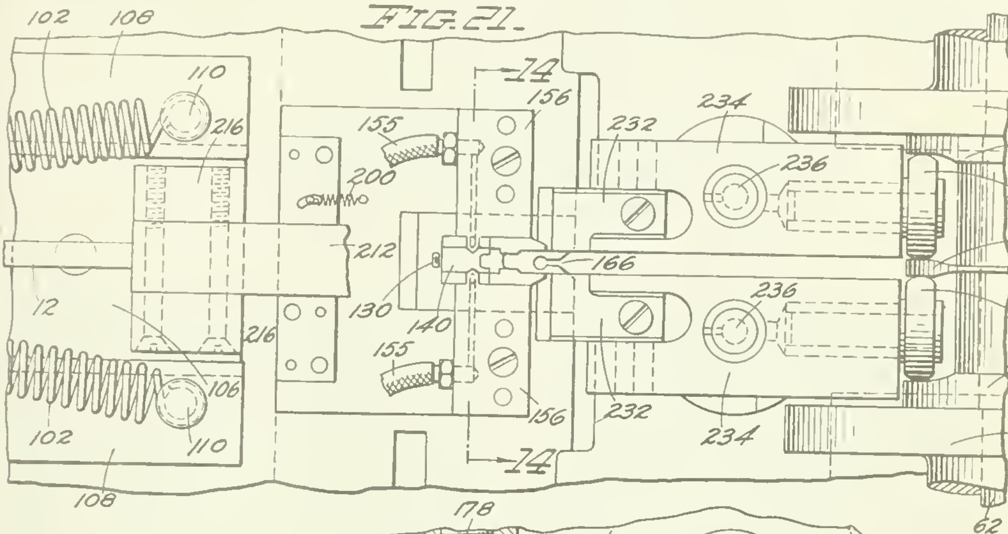
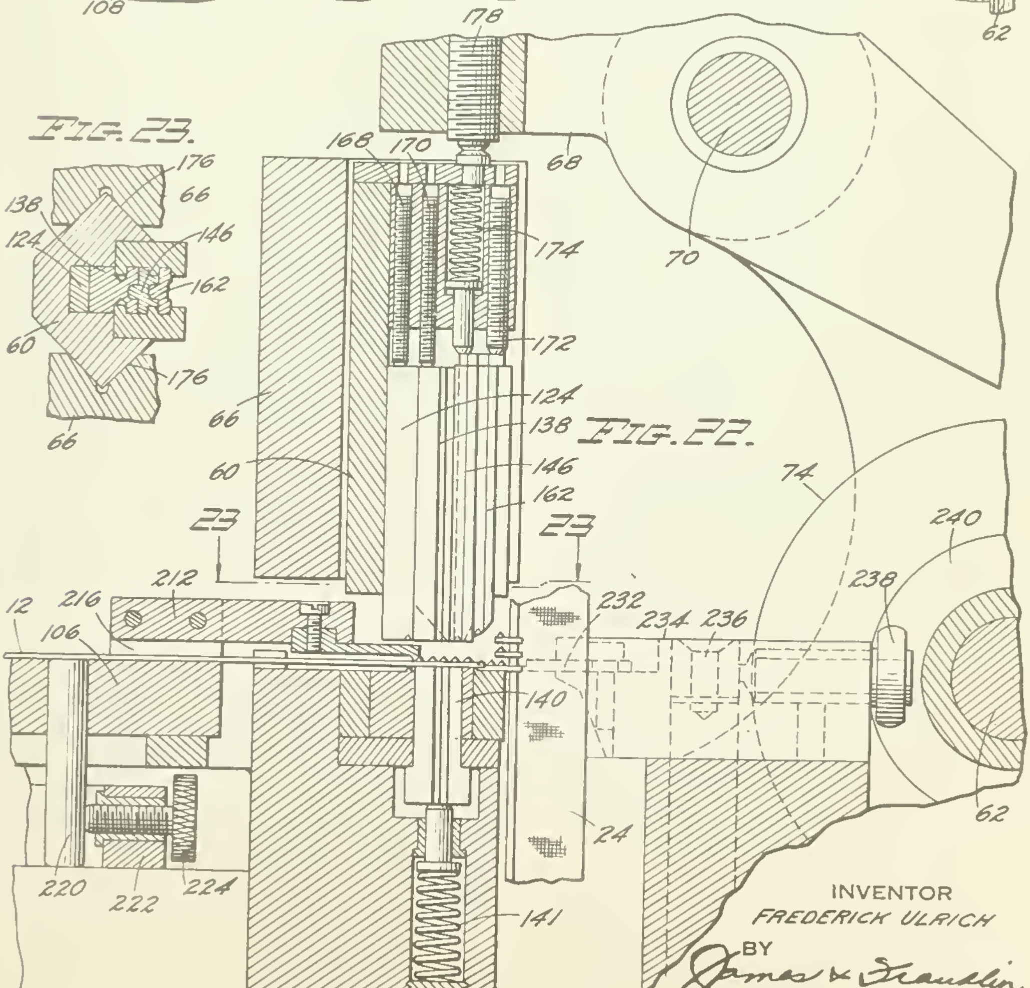


FIG. 23.

FIG. 22.



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UNITED STATES PATENT OFFICE

2,302,075

SLIDE FASTENER MANUFACTURE

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Application March 28, 1939, Serial No. 264,551

13 Claims. (Cl. 153—1)

This invention relates to slide fasteners and more particularly to the manufacture thereof.

The present application is a continuation-in-part of my co-pending application, Serial No. 179,299, filed December 11, 1937, Patent No. 2,221,740, dated November 12, 1940, and entitled "Manufacture of slide fastener elements." It is also a companion application to my co-pending application, Serial No. 264,550, filed concurrently herewith. In said companion application, the manufacture of slide fasteners is divided into two stages, the first stage being the rolling of a smooth wire to form what may be termed a fastener wire, said wire being characterized by a closely spaced series of projections and recesses therealong, and also a closely spaced series of side notches. The spacing and configuration of the parts are such as to correspond to a series of embryo elements, provided that the head of one element is nested fully within and substantially fills the space within the spread jaws of the next element. The first stage of the process is preferably performed in a special rolling apparatus or rolling mill. The second stage of the process consists in severing the aforesaid rolled or deformed wire into separate fastener elements, and attaching the same in spaced relation along the edge of a tape.

The primary object of the present invention is to so design the attaching machine as to adapt the same to receive a smooth flat wire instead of a specially deformed fastener wire, or differently expressed, the primary object of the present invention is to completely eliminate the first stage of the process disclosed in my companion application, thus dispensing with the rolling mill.

Many features of the present attaching apparatus correspond to related features of the attaching apparatus disclosed in my aforesaid companion application, and many objects of the present invention similarly correspond to some of the objects in said application. For example, an object of the present invention is to minimize scrap or waste material when forming the fastener elements. Another object is to eliminate angular disposition of an element when clamped on the tape, either due to the pressure of the severing punch or due to a bend or kink in the wire. Further objects are to facilitate clamping of the jaws of an element on the tape even if the elements are laid out on such a pattern that the jaws of a succeeding element overlap those of a preceding element; to provide ample room for the various punches required in the machine without, however, interposing an excessive number of severed elements between the wire and the tape; to properly support and confine the severed elements between the end of the wire and the tape, and to prevent improper orientation thereof; to prevent longitudinal separation of the elements; to round the lower edge at the periphery of the head of the element; to so form the elements that they have parallel sides when the jaws are closed on the tape; and to insure thorough removal of bits of scrap or waste, even though these are comparatively minute in dimension.

Other objects of my invention having to do more particularly with the specific type of fastener machine here disclosed are to provide a forming punch for forming the interlocking means, or more specifically, the projections and recesses for the elements; to provide feed means adapted to successfully and accurately feed the metal stock, despite the fact that the stock is perfectly smooth until after it has been acted upon by the punches of the machine; and finally to provide means to interrupt the supply of fastener elements to the tape when a gap or space is to be provided on the tape between stringers, without necessitating interruption of the drive for the feed mechanism, and while keeping the severed elements locked against accidental movement by means of the punch assembly.

To the accomplishment of the foregoing and other objects which will hereinafter appear, my invention consists in the apparatus elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a side elevation of an apparatus embodying features of the present invention;

Fig. 2 is a plan view of a piece of stock formed and severed adjacent the tape and is explanatory of the invention;

Fig. 3 is a side elevation of the parts shown in Fig. 2;

Fig. 4 is a section through the smooth flat stock used in practicing the present invention;

Fig. 5 is a similar section after operation of the forming punch to form a projection and recess;

Fig. 6 shows the relation of the elements when severed;

Fig. 7 illustrates the application of an element to the tape before closing of the jaws;

Fig. 8 is a similar view after closing of the jaws;

Figs. 9 and 10 illustrate a detail explanatory of the notching of the side edges of the stock;

Fig. 11 is a plan view of the die taken approximately in the plane of the line 11—11 of Fig. 19;

Fig. 12 is an inverted plan view of the punch assembly taken approximately in the plane of the line 12—12 of Fig. 19;

Fig. 13 shows the attaching apparatus in plan;

Fig. 14 is a detail explanatory of an air blast arrangement for the removal of scrap, this figure being a section taken approximately in the plane of the line 14—14 of Fig. 21;

Fig. 15 shows the upper part of the attaching apparatus in elevation;

Fig. 16 is a detail looking in the plane of the line 16—16 of Fig. 15;

Fig. 17 is a plan view explanatory of the feed mechanism, severing die, and clamping plates;

Fig. 18 is an end elevation of the parts shown in Fig. 17;

Fig. 19 is a section through the die with the punches in elevated position;

Fig. 20 is a similar section with the punches in down position;

Fig. 21 is a plan view of a part of the attaching apparatus drawn to enlarged scale;

Fig. 22 is a section taken in elevation through the ram and feed mechanism; and

Fig. 23 is a section through the ram, it being taken approximately in the plane of the line 23—23 of Fig. 22.

The fastener elements are formed from a strip of metal or wire indicated at 12 in Figs. 2 and 3. A section through this wire, drawn to enlarged scale, is shown in Fig. 4, and it will be observed that the wire is simple smooth flat stock. It is fed directly into the present apparatus, and is operated upon by a suitable forming punch to provide interlocking means, or more specifically, to provide a projection 14 on one side and a recess 16 on the opposite side. The recess 16 provides metal for the projection 14, as will be clear from inspection of Fig. 5. The wire 12 is next acted upon to notch the side edges by removing small triangular pieces of scrap, as is shown at 18 in Fig. 2. The object of this is to so shape the jaws of the elements that the jaws are brought to conventional parallel condition when closed. It will be observed in Fig. 2 that the pitch or spacing of the projections 14 and notches 18 is very close, these projections and notches corresponding to fastener elements only if the head of one element is disposed fully within the jaws of the next element, as is indicated at the right hand part of Fig. 2.

The stock is severed on the line 20 (Fig. 2) to form an individual fastener element. The severed element is restored to nested relation between the jaws at the end of the wire 12, and so a series of nested elements are formed and fed along, jaw first, toward the beaded edge 22 of a conventional tape 24. If desired, the elements may be acted upon by a rounding or finishing punch between the severing punch and the tape, all as is described in greater detail hereinafter.

The configuration of the fastener elements is better shown in Fig. 6, in which it will be seen that the head 26 of one element is located within and conforms to the interior of the jaws 28 of the next element, the head filling the space between the spread jaws. In other words, the jaws are so spaced and shaped as to receive the head 26 of the preceding element. In Fig. 7, I show an individual element moved against the beaded edge 22 of tape 24. The jaws are then closed, as shown in Fig. 8. The outer edges 30 of the jaws change from a divergent position to parallel position, and are preferably spaced apart an amount equal to the width of the head 26. The ends 32 of the jaws are preferably disposed substantially perpendicular to the outer edges 30, so that when the jaws are closed the ends 32 form a bearing surface for the slider of the finished slide fastener, which bearing surface is substantially perpendicular to the tape, as shown in Fig. 8. When the element is completed and fastened to the tape, it does not differ noticeably in external appearance from elements made by more conventional methods. At the inside the jaws are preferably provided with short walls 34 which provide a substantial bearing surface to prevent cutting or penetration of the tape.

Another detail may be described with reference to Fig. 6. The sides of the head are non-parallel, as is indicated by the angle *a*. Differently expressed, the head is necked or narrowed very slightly, as at the point 36, thereby providing an undercut relation between the successive elements. Even if this undercut is only a few thousandths of an inch, it is adequate to prevent longitudinal separation of the elements. When the element is closed there may be slight recess at the point 36 (Fig. 8), but this is not noticeable to the eye, and has been greatly exaggerated in the drawing. The undercut does not prevent transverse separation of the elements, such as takes place when the tape is moved vertically with the clamped element thereon.

The apparatus is shown in Fig. 1 of the drawings. A reel 40 of the flat metal wire is supported on a suitable stand 42. The wire is taken from reel 40 and is fed to a machine generally designated 44. A loop of slack wire 46 may be maintained between the reel 40 and machine 44, as by means of a feeler 48 controlling a motor 50 for intermittently unwinding the reel 40. The wire is intermittently fed toward a tape which is supported in vertical position, the tape being intermittently fed upwardly about a feed drum 52, and thence downwardly through a guide tube 54 into a suitable basket 56.

The head of machine 44 is shown in greater detail in Figs. 13 and 15 of the drawings. It comprises a timing shaft or cam shaft 62, carrying a pulley 64 belted to a driving motor. The punches are carried by a ram 60 (Fig. 13) slidable in a ram housing 66. The ram is reciprocated by a generally U-shaped rocker 68, pivoted on a spindle 70. The ends of the two branches of the rocker carry cam follower rollers 72 engaging cams 74 on cam shaft 62. The tape 24 is fed intermittently upward by means of tape feed drum 52, the tape being held frictionally against the drum by means of a shoe 78 (Fig. 15). Drum 52 is moved by a suitable pawl and ratchet mechanism, the ratchet wheel 80 (Fig. 13) being mounted at the end of a shaft 82 carrying the feed drum 52. Ratchet wheel 80 cooperates with a holding pawl 84 (Fig. 15) and a feed pawl 86, the latter being carried on an arm 88 pivoted on shaft 82 and having an oppositely extending arm 90 oscillated by means of a connecting rod 92 leading to an eccentric 93 (Fig. 15) on cam shaft 62.

The flat wire 12 is intermittently fed in a horizontal direction toward the tape 24 by feed mechanism which is described later, but at this point it may be observed that a feed dog (not shown) is carried on a slide 106, and is retracted or moved outwardly by means of a feed lever pivoted at 94 (Fig. 13), the arm 96 of the feed lever carrying a cam follower roller 98 engaging a cylindrical cam 100 mounted on cam shaft 62. The forward or feed movement of the slide 106 is caused by pull springs 102 which are connected at one end to pins 104 projecting upwardly from the slide within the stationary gibs 108. The opposite ends of springs 102 are connected to stationary pins 110. The operation of the feed dog, while positive in the rearward direction, is yieldable in the forward direction, the reason for which is later explained.

The apparatus further includes a counter generally designated 112 (Fig. 13), the counter being connected by means of link 114 to a suitable eccentric or crank pin on cam shaft 62. After a predetermined number of fastener elements has been attached to the tape, the counter functions to interrupt the feed of the wire, without, however, interrupting the feed of the tape. More specifically, the counter energizes a solenoid 116 which draws an iron core 118 (Fig. 15) upwardly or inwardly, thereby causing a detent 120 to slip beneath a cross bar 122 extending between the arms of the rocker 68. The parts are so related that detent 120 slides beneath cross bar 122 only when the cross bar is in elevated position, that is, at the rise of the cams 74. The ram 60 is thus held in depressed position, and consequently the formation of additional fastener elements is interrupted until the solenoid 116 is again deenergized.

The punches carried by ram 60 may be described with reference to Figs. 12, 19 and 20 of the drawings. The forming punch is indicated at 124. This is recessed at 126 to form the desired projection on top of the wire. Punch 124 cooperates with a fixed die member 128 (see also Fig. 11), which is provided with a projection 130 to form the recess at the bottom of the wire. Projection 130 may be part of an insert in die member 128, instead of being integral therewith as shown.

The notching and severing punches are combined, and the combined punch is numbered 138. A spring pad 140 is located therebeneath. Punch 138 cuts the wire away from an element beyond the punch. The element 142 (Fig. 20) rests on the top surface of a stationary die member 144. It is held by spring pad 146, nested alongside the punches 124 and 138. In Fig. 19, the punches 124 and 138 and the pad 146 are shown in up position, while the wire 12 is elevated by spring pad 140. In Fig. 20, the punches are shown in down position, and while element 142 is held against die member 144 by pad 146, the punches 124 and 138 have forced the wire 12 down together with the spring pad 140, the wire being sheared completely from the element 142, and being provided with an additional projection and recess. When the ram 60 again rises, the wire 12 is raised by spring pad 140, thus restoring the jaws at the end of the wire to the head of the severed element 142.

The triangular notches (18 in Fig. 2) are formed by the punch 138 cooperating with appropriate stationary die parts. Referring to Fig. 11, the die has stationary die surfaces 154 which are pointed to conform to the desired notches in the wire. The spring pad 140 is indented to accurately receive the points 154. In Fig. 12 it will be seen that the punch 138 is provided with four heels 156, and that the punch is indented at 158 between the heels to mate with the die surfaces 154 of Fig. 11. Figs. 9 and 10 are fragmentary transverse sections at the die surfaces 154. In Fig. 9, the punch 138 is raised and spring pad 140 supports the wire 12 in elevated position. The triangular scrap or notch portion 18′ of the wire is disposed about the stationary die surface 154 previously referred to. In Fig. 10, the punch 138 has moved down to the end of its stroke, thereby severing the wire 12 from the triangular piece of scrap 18′, the latter remaining on the stationary die surface 154.

Inasmuch as the pieces of scrap are very tiny, it is desirable to insure dependable discharge of the same. Referring to Fig. 21, compressed air is supplied through pipes 155 to blocks 156 on top of the die. Changing now to Fig. 14, the compressed air is led inwardly through passages 157 and is then directed downwardly alongside the punch 138. The compressed air then flows outwardly through the passages 158, carrying the scrap with it, and then downwardly through discharge passages 160 leading to a suitable box beneath the machine.

As a refinement which, however, is by no means essential, I prefer to provide the apparatus with a finishing or rounding punch, this being indicated at 162 in Figs. 19 and 20. It is moved together with the other punches and forms a part of the punch assembly. The stationary die surface therebeneath is depressed and rounded somewhat, as is indicated at 164 in Figs. 3 and 19. The rounding punch 162 forces the subjacent element into the die curvature at 164, and thereby rounds the lower edge of the head. In Fig. 11 the downward step of the die surface is clearly indicated at 164, and its outline conforms to the exterior of the open-jawed fastener element. The fastener element remains at the slightly lower elevation of the right-hand part of the die surface until it reaches the tape and tape guide 166. Reverting to Figs. 2 and 3, there are five severed elements between the wire 12 and the tape 24, and the rounding punch operates upon the middle one of these five elements. The last two elements are always at the lower die level. The middle element is initially at the upper die level, but is moved to the lower die level by the rounding punch. The difference in elevation may be very slight, say $^{15}/_{1000}$ of an inch.

The mounting of the punch assembly is shown in Fig. 22, in which it will be seen that the forming punch 124 may be adjusted by means of a screw 168; the notching and severing punch 138 is adjusted by means of a screw 170; and the rounding punch 162 is adjusted by means of a screw 172. The spring pad 146 is nested between the punches 138 and 162, and is yieldably urged downward by means of a spring 174. The entire punch assembly is carried by ram 60 which is reciprocable in the guide or ways of ram housing 66. The relation between ram 60 and rocker 68 may be adjusted by screw 178. Fig. 23 shows the forming punch 124, the notching and severing punch 138, the spring pad 146, the rounding punch 162, and the ram 60, which in turn has its edges received in guides or ways 176 formed in the ram housing 66. Fig. 22 also shows the spring 141 supporting the spring pad 140 of the die.

It may be pointed out, with reference to Fig. 12, that the punch 138 is cut away at 180 to clear the projections on the wire reaching the cutting edge of the punch. The spring-pressed pad 146 is recessed at 182 to fit around the projection of the element being severed from the wire, hence the pad acts as a locating pad to insure a uniform location of the periphery of the head about the projection and recess. The spring pad 146 is cut away at 184 to clear the projection of the next element. The rounding punch 162 is recessed at 186 to fit about the projection of the element being rounded, in order not to flatten or deform the element. This punch is also cut away at 188 to clear the projection of the next element. These recesses are also shown in Fig. 19, the severing punch 138 being cut away at 180; the spring pad 146 being recessed at 182 and cut away at 184; and the rounding punch 162 being recessed at 186 and cut away at 188.

To make the feed of the wire positive and accurate, it is fed by means of a dog 190 (Fig. 19) which bears against the most recently formed projection on the wire. The dog may be rigidly mounted because no vertical movement is required. I prefer to feed the wire with the aid of the projection thereon, even though this necessitates movement of the feed dog 190 beneath the forming punch 124, as is clearly shown in Fig. 19. Feed dog 190 is retracted to the position shown in Fig. 20 before the punch descends. There is little or no tendency for the wire to move back with the feed dog, because the wire is smooth, and any such tendency is adequately resisted when using an undercut relation between the severed elements, such as was heretofore described in connection with Fig. 6. A check dog or lock for the flat wire is therefore optional rather than essential, but such a lock is shown in Figs. 17 and 18 of the drawings.

The wire 12 moves between guides 192 and 194. Guide 194 is cut away to receive a lock 196 pivoted at 198 and normally urged in clockwise direction by means of a spring 200, the right-hand end of which is carried by a stationary pin 202, and the left-hand end of which is connected to a pin 204 projecting upwardly from lock 196 and passing through an appropriate slot 206. The end 208 of the lock 196 is made eccentric with respect to the center 198, and the operation is such that the wire 12 is automatically locked against rearward movement, though no substantial resistance is offered to forward movement.

The feed dog 190 is rigidly secured at 210 to an arm 212 (Figs. 17, 19 and 20) which in turn is rigidly secured to the slide 106 (Figs. 13, 15, 16, 21 and 22). In the present case, arm 212 is fixedly mounted between ears 216 formed integrally with and projecting upwardly from the slide 106. The slide 106 is reciprocable in guides or ways formed in a part 218 (Fig. 16) of the machine, the slide being held in position by means of the gibs 108. A pin 220 (Figs. 15, 16 and 22) depends from the slide 106 and is operated upon by the end 222 of the feed arm 96, through an adjusting screw 224. Inasmuch as the part 222 of the feed arm bears against one side only of pin 220, (it being cut away on the opposite side of the pin), the slide is moved positively toward the left, while its movement toward the right is solely under the influence of the feed springs 102.

When producing a gap or space between stringers the punch assembly is locked in its down position, as shown in Fig. 20, and the forming punch 124 is therefore disposed directly in front of the then retracted feed dog 190. The feed cam 100 (Fig. 13) continues its rotation, but the feed dog, and with it the slide 106 and the feed arm 96, are held in retracted position. The parts may vibrate slightly if there is a substantial clearance between the end of the feed dog 190 and the punch 124, but this vibration, even if permitted, is harmless, and in practice may be reduced to a negligible amount by using only a slight clearance between the feed dog and the forming punch. Locking the ram in down position eliminates unnecessary reciprocation, and avoids moving the jaws at the end of the wire repeatedly into and out of engagement with the head of the element last severed.

The endmost element is clamped on the tape by an oppositely movable pair of clamping plates. Referring to Figs. 21 and 22, the clamping plates 232 are secured to levers 234 pivoted at 236. The other ends of the levers 234 carry cam followers 238 which run between cylindrical cams 240, carried on the main shaft 62 of the machine. The cams are so shaped as to oppositely move the clamping plates. Referring now to Fig. 17, it will be seen that the corners 242 of clamping plates 232 are so located as to engage the jaws of the endmost element and at the same time to clear the jaws of the element next to the end. The clamping plates are thinned to come beneath the ends 234 of guides or rails 236 which confine and guide the severed elements. When the clamping plates 232 move together, they compress the spread jaws of the endmost element from the open condition of Figs. 17 and 7, to the closed condition of Fig. 8.

It is believed that the construction and operation of the present invention, will be apparent from the foregoing detailed description. Flat wire is fed to a single machine where it is operated upon by a forming punch to form a projection and recess, and by a severing and notching punch which removes triangular pieces of waste and which severs the wire of the fastener elements so shaped that the head of one element is nested within and substantially fills the space of the spread jaws of the next element. The elements are kept in nested relation and are fed toward an intermittently moved tape where the endmost element is clamped on the tape. If desired, a finishing operation such as that produced by the rounding punch may be applied to the elements between the cutting punch and the tape. The movement of the tape disengages the attached element from the next element, whereupon the series is again advanced to bring another element astride the tape.

In respect to timing, it may be explained that in the first part of the machine the ram descends, and then rises, while the feed dog is retracted. The feed dog then advances and returns, whereupon the ram again descends. In the meantime, in the second part of the machine, the jaws of the endmost element are clamped by the clamping plates, and in this part of the machine the timing is such that the clamping plates are open when the tape rises with the previously clamped element. The timing relation between the two parts of the machine is not at all critical, but it will be understood that the feed dog must move forward after the tape rises with the previously attached element, and that at this time the clamping plates must be wide open. The clamping plates should not be closed until after the feed dog has moved forward.

When a predetermined number of elements have been attached to the tape, as determined by the counter, the counter energizes the solenoid, which holds the ram down, and this in turn holds the feed dog back. The tape continues to be fed by the pawl and ratchet mechanism operating the tape drum.

The many advantages of the invention will also be understood from the detailed description. The invention produces only a small amount of scrap. It utilizes a simple, smooth flat wire, and eliminates die rolling to form embryo elements. The elements are of generally conventional type in that the outer walls of the jaws come into substantially parallel relationship when closed, while the ends of the jaws are substantially perpendicular to the tape. The feed of the wire is made a positive, predetermined amount by operating the feed dog against a projection formed on the wire after the wire has already been operated upon by the forming punch. Locking the ram in down position to provide a gap space prevents loosening of the fit between elements, and automatically interrupts the movement of the feed dog. The use of a series of severed elements provides room for the punches and the associated spring pad. It frees the jaws of the endmost element for the clamping operation, and it avoids angular positioning of the element, as by reason of the punch thrust or a bend in the wire. The sides of the head are non-parallel and converge so as to provide an undercut of the elements after they are severed and engaged, and this prevents longitudinal separation. The nesting of the elements prevents improper orientation as they are moved toward the tape.

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention defined in the following claims.

I claim:

1. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a smooth, flat wire, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, and timing means whereby said feed dog is retracted from the path of the punch when the punch descends.

2. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a smooth, flat wire, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, timing means whereby said feed dog is retracted from the path of the punch when the punch descends, and a severing punch movable transversely of the wire for severing the wire into fastener elements having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws.

3. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittenly feed a tape, means to guide a smooth, flat wire toward the tape, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, resilient means urging the feed dog forward, a feed cam for positively retracting the feed dog when the punch descends, a severing punch movable transversely of the wire for severing the wire into fastener elements, clamping plates for clamping the elements to the tape, a counter, and means responsive to the counter to lock the punch in depressed position, whereby the feed dog is held against forward movement by the punch, in order to provide a gap or space between stringers.

4. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a tape, means to guide a smooth, flat wire toward the tape, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, resilient means urging the feed dog forward, a feed cam for positively retracting the feed dog when the punch descends, a severing punch movable transversely of the wire for severing the wire into fastener elements having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a punch-operating cam, a rocker arm between said cam and the punch, clamping plates for clamping the jaws of the endmost element to the tape, a counter, means responsive to the counter to lock the rocker arm in outermost position with the punch in depressed position, whereby the feed dog is held against forward movement by the punch, in order to provide a gap or space between stringers on the continuous tape.

5. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a smooth, flat wire, a forming punch movable transversely of the wire, said punch functioning to form interlocking means on opposite sides of the wire, a severing punch movable transversely of the wire for severing the wire into fastener elements, and a reciprocable feed dog for intermittently feeding the wire past the punches, said feed dog being so dimensioned and mounted that it acts upon the interlocking means formed by the forming punch in order to provide a positive feed movement for the wire.

6. In the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, the method which includes intermittently feeding a tape, intermittently feeding a smooth, flat wire toward the tape, said wire having a width just equal to the width of an element with spread jaws, each of the repeated feed distances equalling only a small fraction of the length of an element, operating upon the wire to form a recess on one side of the wire and a projection on the opposite side of the wire, and to cut away small triangular pieces of scrap in order to notch the side edges of the strip to conform to the outer ends of spread jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, and to sever the strip away from a small projecting piece of the strip, the severance being on an outline such as to define fastener elements with the head of one element

nested fully within and substantially filling the space within the spread jaws of the next element, whereby the elements are formed without scrap other than the aforesaid small triangular pieces of scrap at the side edges of the wire, restoring the wire and severed element together again in nested relation, intermittently moving the nested severed elements toward the tape, and clamping the jaws of the endmost element on the tape in order to secure the element to the tape, while giving the element approximately parallel sides.

7. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a flat, smooth wire toward a tape, said wire having a width just equal to the width of an element with spread jaws, punches movable transversely of the wire, said punches operating to form a recess on one side of the wire and a projection on the opposite side of the wire, said punches further operating to sever the wire from a piece of the wire projecting beyond the severing punch and corresponding to one element, the outline of the severing punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, a spring pad beneath the wire at the punch to restore the wire to the element previously severed therefrom, feed means to intermittently feed the wire to the punches and tape, each of the repeated feed distances equalling only a small fraction of the length of an element, and clamping plates at the tape for clamping the elements to the tape, said plates having approximately parallel working faces when closed.

8. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire toward a tape, said wire having a width just equal to the width of an element with spread jaws, punches movable transversely of the wire, said punches functioning to form a recess on one side and a projection on the opposite side of the wire, and further functioning to sever the wire from a piece of the wire projecting beyond the severing punch, and corresponding to one element, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, a spring pad beneath the wire at the punch to restore the wire to the element previously severed therefrom, feed means to intermittently feed the wire to the punches and tape, each of the repeated feed distances equalling only a small fraction of the length of an element, the punch being spaced from the tape by an amount such that a series of severed elements nested together with the head of each filling the jaw space of the next lie between the punch and the tape, a rounding punch between said severing punch and said tape, said rounding punch functioning to round the lower peripheral edge of the head of the element, and clamping plates at the tape for clamping the endmost element to the tape, said plates having approximately parallel working faces when closed.

9. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire, punch and die mechanism including a plurality of punches movable transversely of the wire, said punches functioning to form a recess on one side and a projection on the opposite side of the wire, and functioning to cut small triangular shaped pieces of metal from the sides of the wire, and further functioning to severe the wire, the outline of the severing punch being such that the severed piece constitutes a fastener element having a head with spread jaws, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, air blast means for helping remove said small triangular pieces of scrap, and feed means to intermittently feed the wire to the punches, each of the repeated feed distances equalling only a small fraction of the length of an element.

10. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire toward a tape, punch and die mechanism including a plurality of punches movable transversely of the wire, said punches functioning to form a recess on one side and a projection on the opposite side of the wire, and functioning to cut small triangular shaped pieces of metal from the sides of the wire, and further functioning to sever the wire from a piece of the wire projecting beyond the severing punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, a spring pad beneath the punch to restore the wire to the element previously severed therefrom, stationary die surfaces beneath the wire at opposite sides of the spring pad cooperating with one of the aforesaid punches for removing the small triangular shaped pieces of scrap, air blast means for helping discharge said triangular pieces of scrap, feed means to intermittently feed the wire to the punches and tape, each of the repeated feed distances equalling only a small fraction of the length of an element, and clamping plates at the tape for clamping the elements to the tape, said plates having approximately parallel working faces when closed.

11. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimensions adjacent the head, said apparatus comprising means to guide a smooth, flat wire having a width just equal to the width of an element with spread jaws, a punch and die operating to form a recess on one side of the wire and a projection on the opposite side of the wire, and operating to sever the wire, said die having a generally keyhole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion, said pad lifting the wire clear of the die for forward feed after formation of the projection and recess, said punch having a concave side mating with the aforesaid convex die portion, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, the element being left stationary on the die while the wire is punched downwardly away from the same, the outline of the punch and die being such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, and feed means to intermittently feed the wire to the punch and die, each of the repeated feed distances equalling only a small fraction of the length of an element.

12. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire, a punch and die functioning to form a recess on one side and a projection on the other side of the wire, and further functioning to cut small, triangular pieces of scrap to give the jaws the desired perpendicular ends, and further functioning to sever the wire, said die having a generally key-hole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising two pointed or triangular-shaped side pieces for cutting notches in the side edges of the wire, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion and triangular cutting portions, said pad lifting the wire clear of the die for forward feed after formation of the projection and recess, said punch having a concave side mating with the aforesaid convex die portion, said punch further having triangularly grooved channels in the sides mating with the aforesaid triangular die portions, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, and further severs the wire from two triangular pieces of scrap supported on the aforesaid triangular die portions, the element and scrap being left stationary on the die while the wire is punched downwardly away from the same, the outline of the punch and die being such that the severed piece constitutes a fastener element.

13. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire, punch and die mechanism functioning to form a recess on one side and a projection on the opposite side of the wire, and functioning to cut small triangular shaped pieces of metal from the side of the wire, and further functioning to sever the wire, said die having a generally keyhole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising two pointed or triangular-shaped side pieces for cutting notches in the side edges of the wire, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion and triangular cutting portions, said pad lifting the wire clear of the die for forward feed after formation of the projection and recess, said punch having a concave side mating with the aforesaid convex die portion, said punch further having triangularly grooved channels in the sides mating with the aforesaid triangular portions, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, and further severs the wire from two triangular pieces of scrap supported on the aforesaid triangular die portions, the element and scrap being left stationary on the die while the wire is punched downwardly away from the same, the outline of the severing punch being such that the severed piece constitutes a fastener element having a head with spread jaws, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, air-blast means for moving said small triangular pieces of scrap outwardly from the triangular die portions, and feed means to intermittently feed the wire to the punch and die, each of the repeated feed distances equalling only a small fraction of the length of an element.

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DEFENDANT'S EXHIBIT "BV"

F. Ulrich Patent No. 2,338,884

Filed Nov. 1, 1940 Patented Jan. 11, 1944

APPARATUS FOR MAKING SLIDE FASTENERS

Filed Nov. 1, 1940 5 Sheets-Sheet 1

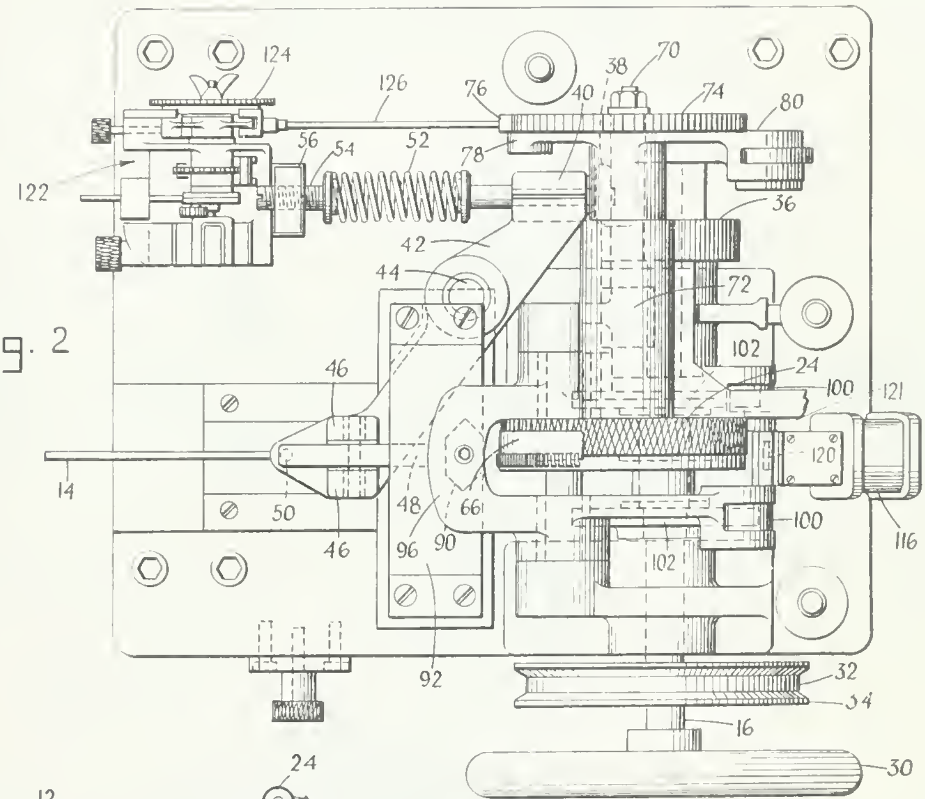

Fig. 2

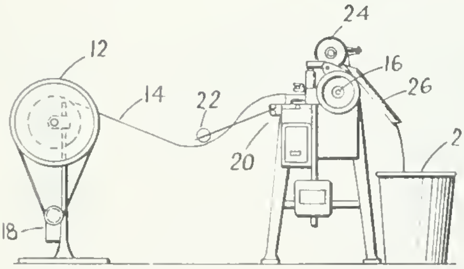

Fig. 1

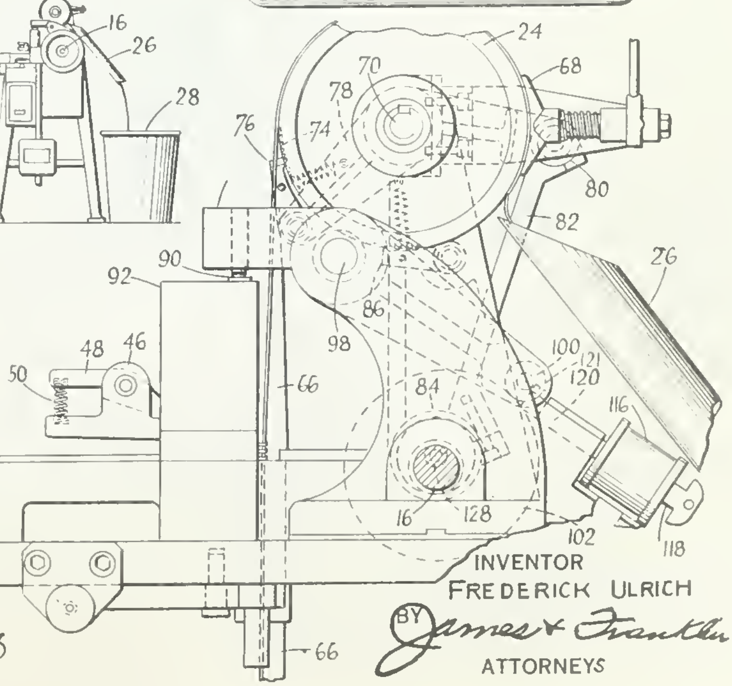

Fig. 3

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APPARATUS FOR MAKING SLIDE FASTENERS

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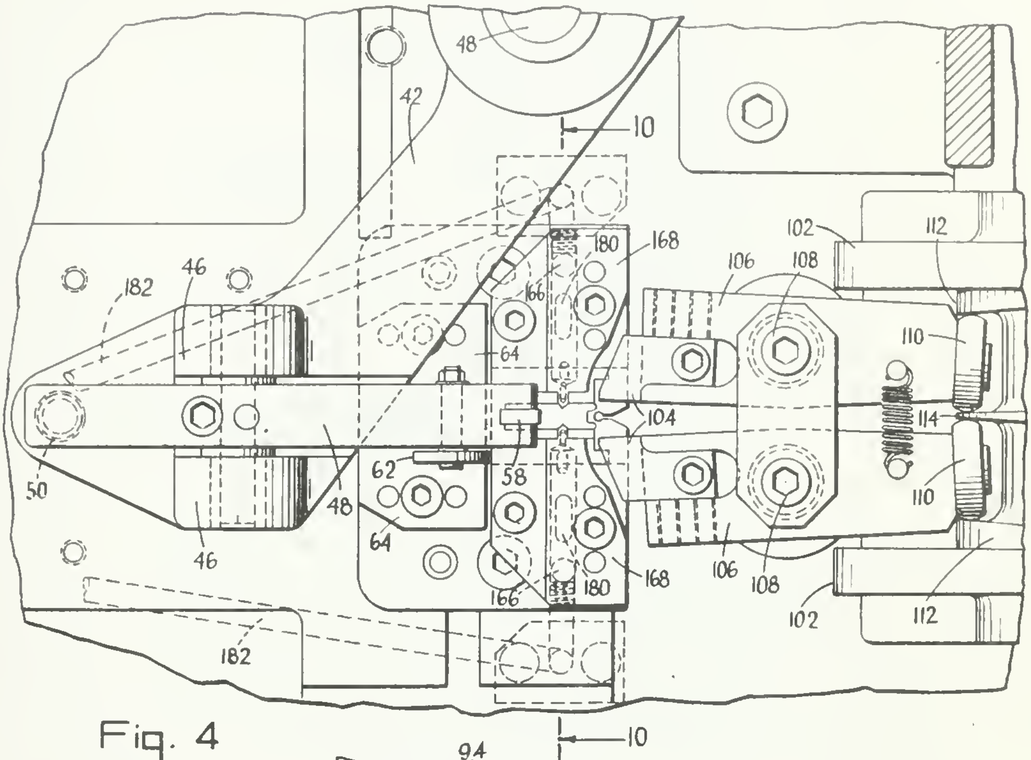

Fig. 4

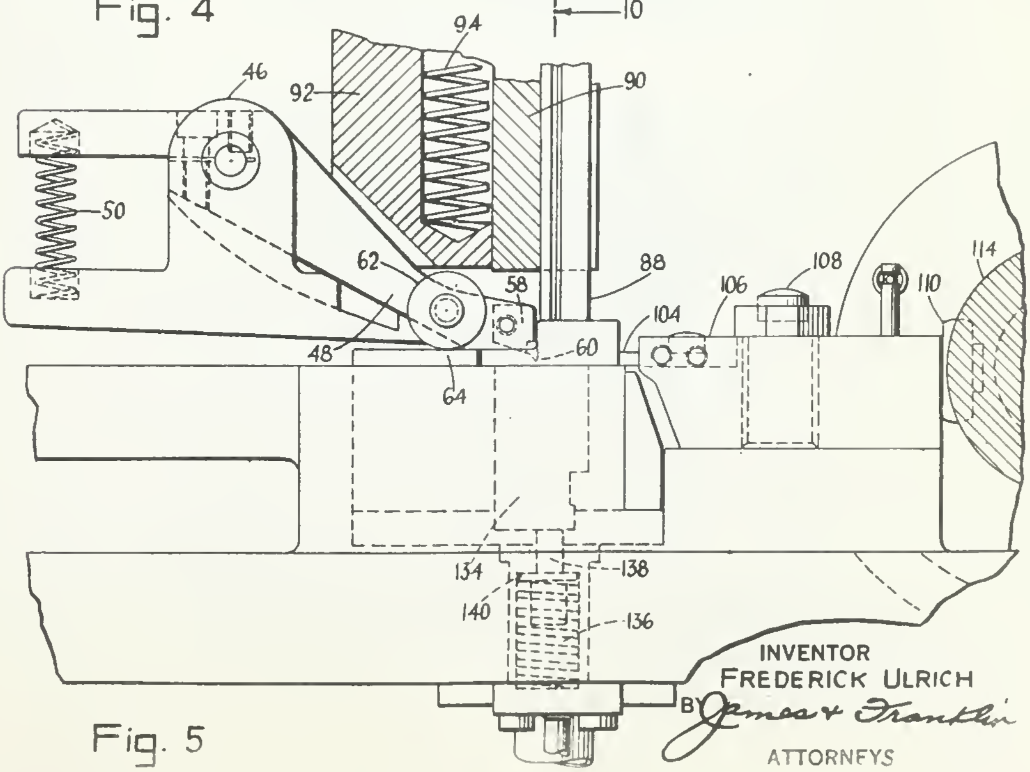

Fig. 5

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APPARATUS FOR MAKING SLIDE FASTENERS

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Fig. 6

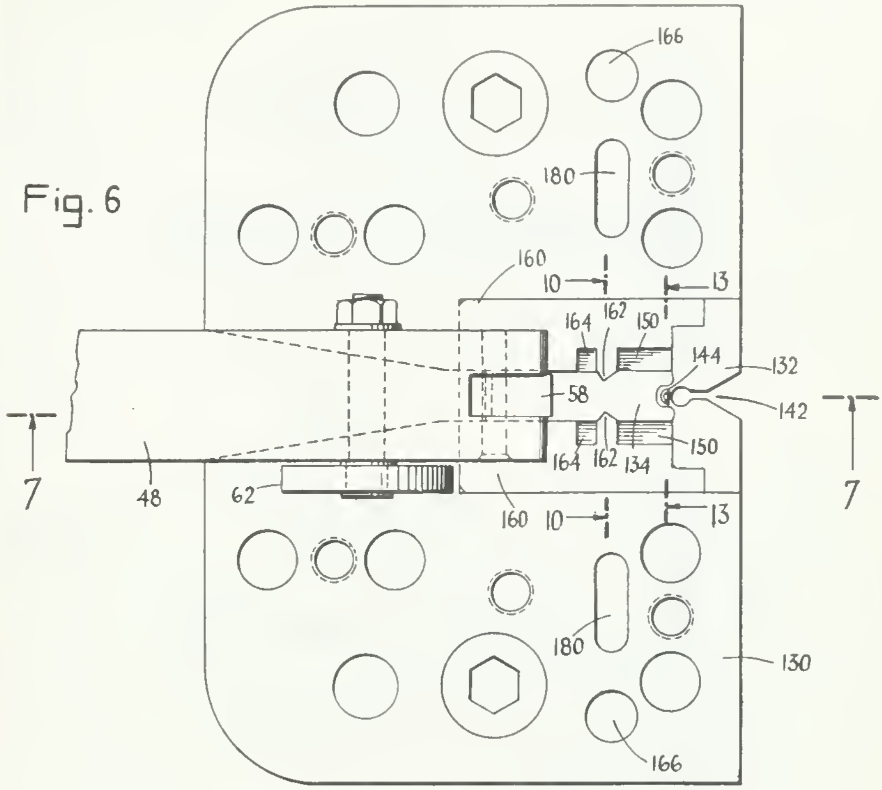
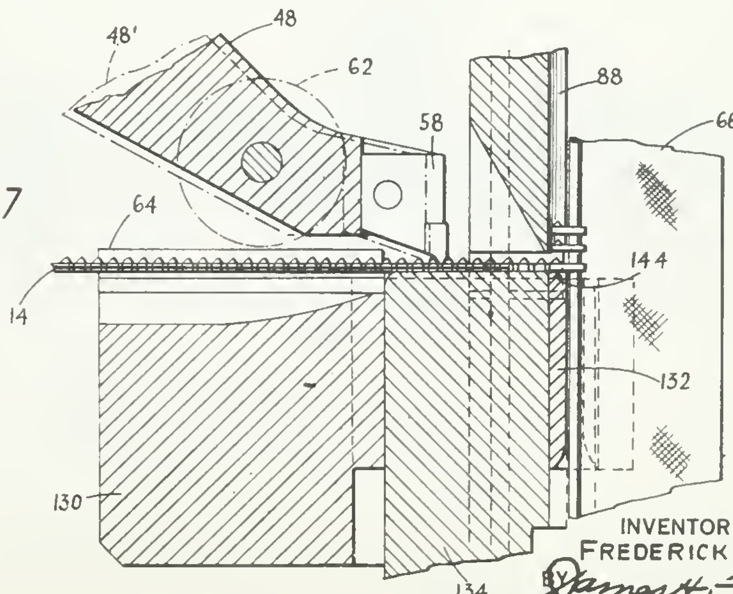


Fig. 7



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Jan. 11, 1944. F. ULRICH 2,338,884

APPARATUS FOR MAKING SLIDE FASTENERS

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Fig. 8

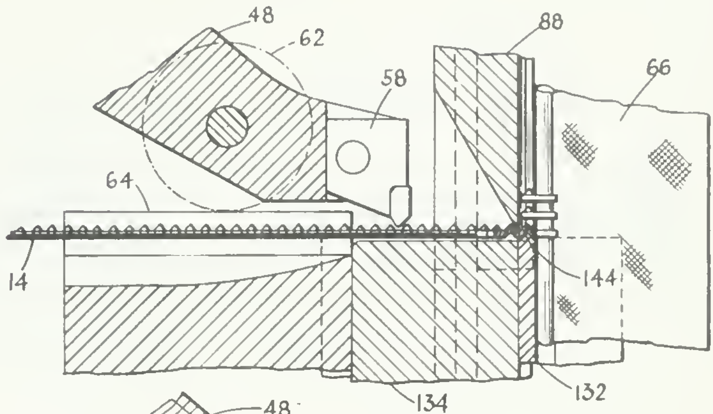

Fig. 9

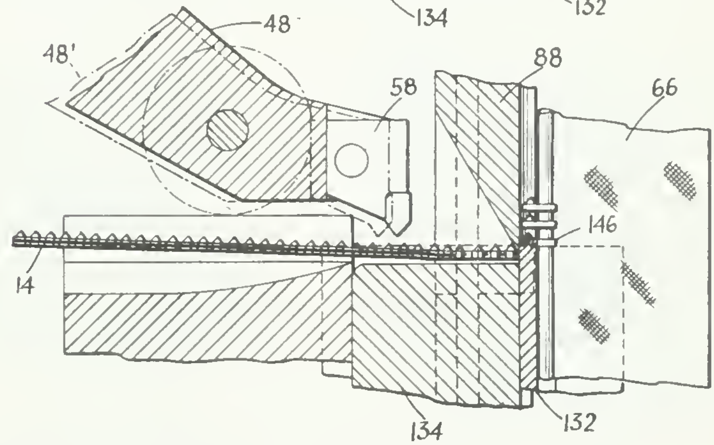

Fig. 10

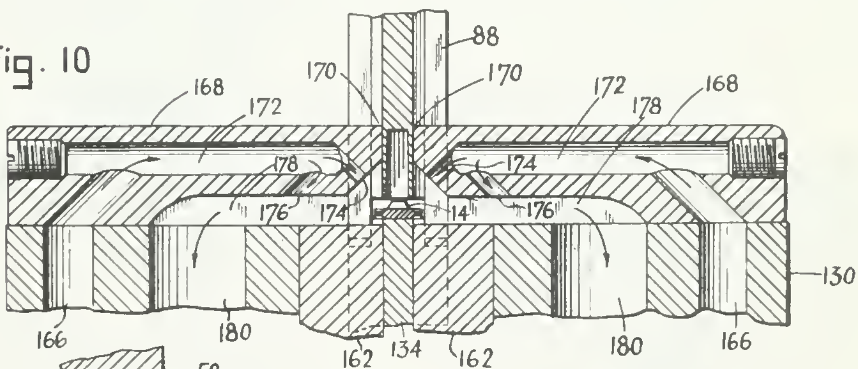

Fig. 11

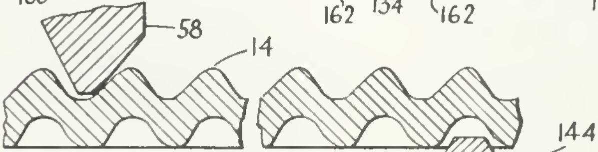

Fig. 12

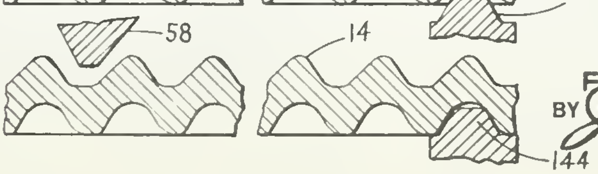

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Fig. 13

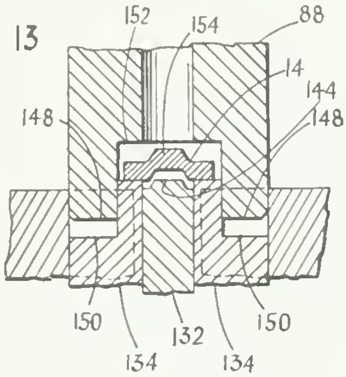


Fig. 17

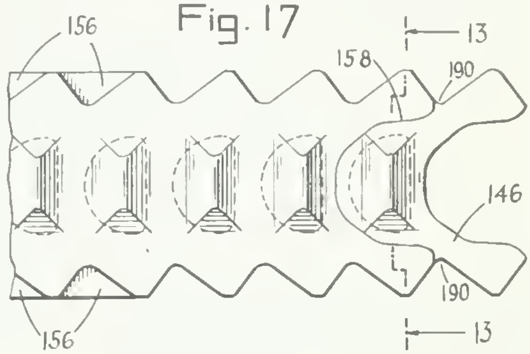


Fig. 14

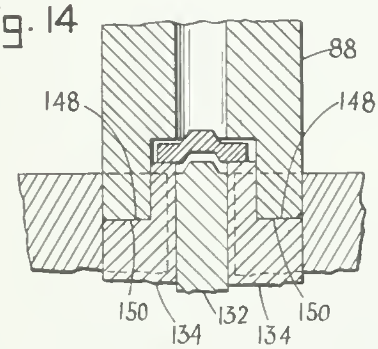


Fig. 18

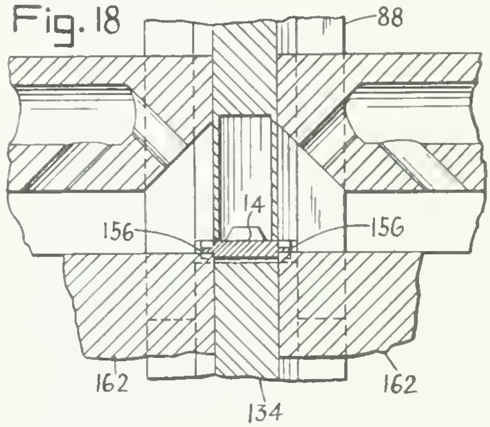


Fig. 15

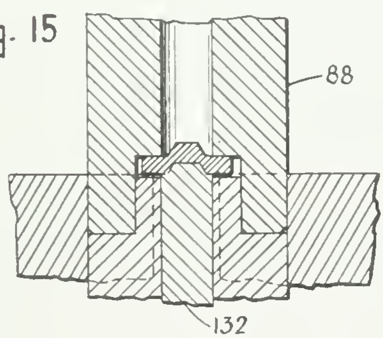


Fig. 19

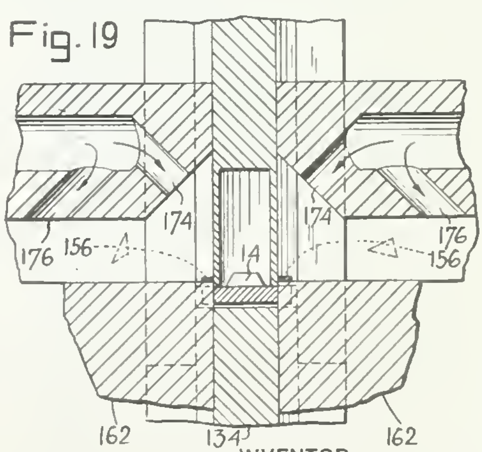
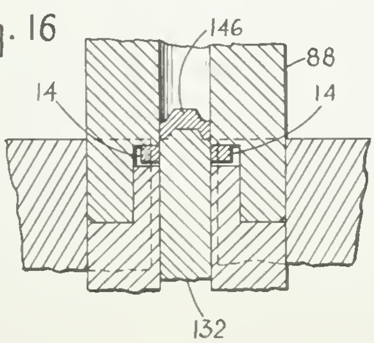


Fig. 16



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2,338,884

APPARATUS FOR MAKING SLIDE FASTENERS

Frederick Ulrich, Bayonne, N. J., assignor to Conmar Products Corporation, Bayonne, N. J., a corporation of New Jersey

Application November 1, 1940, Serial No. 363,804

10 Claims. (Cl. 153—1)

This invention relates to apparatus for making slide fasteners, and more particularly to a machine for severing embryo slide fastener elements and attaching the same to a tape.

The primary object of my invention is to provide apparatus of the aforesaid character, and more particularly improved apparatus for practicing the method disclosed in my co-pending applications Serial No. 179,299, filed December 11, 1937, and Serial No. 264,550, filed March 28, 1939, of which applications the present application is a continuation-in-part.

One more specific object of the present invention is to provide pilot means for exact location of the fastener element being severed, in order to improve the accuracy of said element.

Other objects center about the feed mechanism for feeding the fastener wire to the severing punch and are to redesign and lighten the feed arm for high-speed operation; and to so mount the dog that it may be moved upwardly when the spring pad of the die raises the wire, yet is stopped from moving downwardly during retraction of the dog, and is stopped before the element being severed comes into engagement with the aforesaid pilot, thereby freeing the fastener wire for proper seating or self-adjustment of the said element on the pilot.

In accordance with my invention as disclosed in the aforesaid application Serial No. 179,299, filed December 11, 1937, the fastener wire is provided with serrated edges in order that the finished elements may be formed with parallel sides and perpendicular ends for best cooperation with the slider. When making slide fastener wire by a rolling process, the wire will ordinarily come out with a thin residue or fin at the serrated edges. This fin may be removed by the punch and die mechanism of the attaching apparatus but, in such case, the use of an air blast is desirable in order to help insure removal of the tiny bits of scrap or fin cut from the wire. A further object of the present invention is to improve the air nozzle arrangement for discharging the scrap, and in accordance with my invention, while a part of the air stream may be directed into the punch and die, a larger portion of the air stream is diverted to flow outwardly into the scrap discharge path, thus helping draw the bits of scrap away from the punch and die.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the apparatus elements and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings, in which:

Fig. 1 is a side elevation of apparatus embodying features of my invention;

Fig. 2 is a plan view of the head of the machine;

Fig. 3 is a side elevation of the head of the machine;

Fig. 4 is a plan view of a fragmentary portion of the machine, drawn to enlarged scale, with the ram and housing removed to expose the clamping jaws;

Fig. 5 is a partially sectioned elevation of the portion of the machine shown in Fig. 4;

Fig. 6 is a plan view of the die and feed dog without the ram housing and air blast nozzles and wire guides;

Fig. 7 is a section taken in elevation through the feed dog and punch, approximately in the plane of the line 7—7 of Fig. 6, and schematically illustrates the forward feed of the fastener wire;

Fig. 8 is a similar view showing the relation of the parts as the punch brings the endmost element onto the pilot;

Fig. 9 is a similar view showing the relation of the parts as the punch finishes its severing stroke and the feed dog is retracted;

Fig. 10 is a transverse section through the punch and air nozzles, taken approximately in the plane of the line 10—10 of Fig. 4;

Fig. 11 is a fragmentary section taken in elevation through the feed dog and pilot as the wire reaches the pilot;

Fig. 12 is a similar view but showing the relation of the parts when the wire is seated on the pilot;

Fig. 13 is a transverse section taken through the die at the pilot, approximately in the plane of the line 13—13 of Figs. 6 and 17, with the punch and spring pad in raised or feeding position;

Fig. 14 is a similar view showing the punch lowered until its heels meet the spring pad in such manner as to prevent binding of the wire as the wire approaches the pilot;

Fig. 15 is a similar view showing the punch lowered until it meets the wire preparatory to severing the same;

Fig. 16 is a similar view showing the punch in lowermost position;

Fig. 17 is a plan view of the end of the fastener wire drawn to enlarged scale;

Fig. 18 is a transverse elevational section similar to Fig. 10, but showing the punch lowered until the fin engages the die; and

Fig. 19 shows the relation of the parts at the end of the fin-cutting operation.

Referring to the drawings, and more particularly to Fig. 1, a reel 12 of slide fastener wire 14 is fed to attaching apparatus, the main drive and cam shaft of which is indicated at 16. Reel 12 may be unwound at intervals to provide a loop of slack between it and the attaching apparatus, as by means of an electric motor 18 controlled by a switch 20 moved by a feeler 22. The finished slide fastener stringer or so-called "chain" is fed over a feed wheel 24 through tube 26 into basket 28.

Referring now to Figs. 2 and 3, the main drive and cam shaft 16 is provided with a hand wheel, or/and fly wheel 30 and is driven by a suitable electric motor through belt 32 and pulley 34. The wire feed mechanism comprises a cylindrical cam 36 operating on a ball-bearing cam follower 38 mounted on the end 40 of a small compact feed arm 42 preferably made of Duralumin or equivalent light-weight metal. The Duralumin is preferably a heat treated material known commercially as 17 ST. The feed arm is pivoted at 44, and the movable end is provided with ears 46 pivotally carrying a feed dog 48 acted on by a compression spring 50. The cam follower is held in engagement with the cam by means of a compression spring 52, the tension of which may be adjusted by means of a screw 54 threadedly received in a stationary block 56.

Referring now to Figs. 4 and 5, the forward end of the feed dog carries an insert or tooth 58 having a suitably shaped hardened point 60. The feed dog 48 is arrested against downward movement at a desired point, for reasons later explained, and as here illustrated is provided with a suitable anti-friction roller 62 adapted to ride on the surface of part 64 of the die which part may, if desired, be provided with a hardened insert, not shown in the drawings. There are two parts 64 secured on top of the die, as is best shown in Fig. 4, and their combined function is to guide the wire 14. The parts 64 are omitted in Fig. 6.

The beaded edge tape on which the fastener elements are to be mounted is fed upwardly at the bottom of the machine as is indicated at 66 in Fig. 3. The tape is drawn upwardly through the die by means of a suitable knurled feed wheel 24 (Figs. 2 and 3), the tape being held against the wheel by means of a spring-pressed shoe 68. The feed wheel 24 is mounted at one end of a shaft 70 rotatably carried in a stationary bearing 72. The opposite end of shaft 70 carries a ratchet wheel 74. This is acted up by a tape feed pawl 76 carried at the lower end of an angle arm 78, the opposite end 80 of which is connected to the upper end of an eccentric rod 82, the split lower end of which is secured about an eccentric 84 mounted at one end of the drive shaft or cam shaft 16. The ratchet wheel 74 is further acted upon by a stationary holding pawl 86. It will be evident that the tape will be advanced intermittently or step by step as the cam shaft rotates.

The severing mechanism comprises a punch 88 (Fig. 5) carried in a ram 90 which is vertically reciprocable in a ram housing 92, the ram being normally urged upwardly by a compression spring 94, the upper end of which bears against a stud (not shown) projecting from ram 90 over the upper end of the spring. Referring now to Figs. 2 and 3 the upper end of ram 90 is acted on by a generally U-shaped rocker arm 96, the branches of which are pivoted at 98 and carry cam follower rollers 100 at their lower ends. The rocker arm is preferably made of Duralumin or similar light-weight metal in order to facilitate high-speed operation of the machine. The throw of the rocker arm, like the throw of the various other reciprocating parts of this machine, is minimized with the same object in view. Cam rollers 100 are acted on by radial cams 102 mounted on cam shaft 16. It will be evident that rotation of shaft 16 will cause oscillation of the rocker arm and consequent reciprocation of the ram and punch.

The jaws of the fastener elements are clamped on the tape by suitable clamping jaws, and referring to Figs. 4 and 5 the clamping jaws 104 are mounted on levers 106 pivoted at 108 and carrying cam rollers 110 at their opposite ends. Rollers 110 operate between cylindrical cams 112 and 114, thus providing positive movement in both directions. In Fig. 4 the clamping jaws are shown in their open position.

Referring to Fig. 9, gap spacing or the omission of fastener elements between stringer lengths may be accomplished by holding the punch 88 down, thereby holding the fastener wire 14 down as shown, so that the tooth 58 of the feed dog 48 reciprocates idly above the wire without feeding the same. Referring now to Figs. 2 and 3, the machine is provided with a solenoid 116 having a core 118 which is moved upwardly when the solenoid is energized and thereby moves a suitable stop 120 into the path of a bridge 121 connecting the bifurcated ends of the rocker arm. This stop is so located as to move beneath the bridge when the cam wheels of the rocker arm have been raised by the cams, and the stop thus serves to hold the punch in depressed position. This interrupts the feed of elements to the tape and produces the desired gap or spacing between fastener lengths. After a desired interval the solenoid is deenergized, whereupon the reciprocation of the punch and the feed of the wire are resumed.

The time and the length of the feed interruptions may be determined by a suitable counter 122 (Fig. 2) which includes a changeable ratchet wheel 124 acted on by a feed dog oscillated by link 126, the other end of which link is connected to a small crank pin 128 (Fig. 3) on the end of the cam shaft. The counter is provided with suitable contact mechanism controlling the electrical circuit of solenoid 116. The counter may, for example, be of the type disclosed in the Wintritz and Ulrich Patent No. 2,167,259, filed June 17, 1938.

Referring now to Figs. 6 and 7, the die holder 130 is fitted with a stationary die 132 and a vertically reciprocable spring pad 134. The spring pad 134 is elevated by a compression spring 136 (Fig. 5) disposed therebeneath, the said spring operating on a pusher 138 bearing against the pad 134. A collar or enlargement 140 on pusher 138 limits the upward movement of the spring pad to a desired amount.

Reverting to Figs. 6 and 7, the stationary die 132 is provided with a suitable guide slot 142 for the tape 66. It is further provided on its top surface with a pilot 144. Fig. 7 shows the parts in feed position, the punch 88 being raised to clear the projections on top of the fastener wire

14 and the spring pad 134 rising to its uppermost position, which is somewhat higher than the top of stationary die 132 and enough to cause the wire 14 to clear the top of the pilot 144, so that the pilot will not obstruct movement of the wire toward the tape 66. It will also be noted that with the wire in raised position, it is engaged by the feed tooth of dog 48 and, in fact, the dog is raised slightly so that wheel 62 leaves the stop surface 64. The wire is fed toward the right by the amount of the pitch between elements, and this is indicated by the change from the broken line position 48' to the solid line position 48 of the feed dog.

Fig. 8 represents a later stage in the operation of the machine with the punch 88 lowered until its heels engage and lower the spring pad 134. The cutting surface of the punch has engaged and lowered the wire 14 until the endmost element is seated and properly located by the pilot 144. At this time the anti-friction wheel 62 has already reached its stop surface 64, thereby arresting the dog tooth 58 from further downward movement. There is a clearance between the feed tooth and the wire, this being desirable to insure free movement of the wire under control of the pilot 144 as the pilot comes into control.

This point may be clarified by reference to Figs. 11 and 12 in which the parts are drawn to enlarged scale. In Fig. 11 the wire 14 is still under the control of feed tooth 58, but has been lowered far enough to begin to come into the control of pilot 144. Approximately at the point indicated by Fig. 11, however, further downward movement of the feed tooth is prevented, so that by the time the wire 14 is seated on pilot 144 there is a clearance between the wire and the feed tooth 58. Thus the wire can properly seat itself on pilot 144 even though it may have been overfed by the feed dog, thus necessitating a slight backward movement of the wire under influence of the pilot.

In Fig. 9 the punch 88 has descended to lowermost position and has shared the wire from the endmost element 146, the latter resting on and being supported by the stationary die 132. At this time the wire is wholly out of the path of the feed tooth and there is accordingly no obstruction to retraction of the feed dog from the solid line position 48 to the broken line position 48', preparatory to the next feed movement. The cycle of operation is completed by referring back to Fig. 7 in which punch 88 has been raised, thus permitting the pad 134 to raise the wire 14, so that it engages the feed tooth and clears the pilot. Movement of the feed dog from the broken line position 48' to the solid line position 48 moves the wire to bring the jaws at the end of the wire astride the beaded edge of tape 66.

The foregoing cycle of operation may also be described with reference to Figs. 13, 14, 15, and 16 which are taken approximately in the plane of the line 13—13 of Figs. 6 and 17. In Fig. 13 the punch 88 is in elevated position, its heels 148 being located above the mating parts 150 of spring pad 134. The spring pad is in raised position, thus causing the wire 14 to clear the pilot 144 of stationary die 132. The cutting surface 152 of punch 88 is disposed well above the projection 154 on wire 14.

In Fig. 14 the punch 88 has descended far enough to cause the heels 148 to engage the surfaces 150 of the spring pad 134. It will be noted that the heels of the punch are long enough to provide a clearance around the wire, this clearance being shown above the wire in Fig. 14 and below the wire in Fig. 15 but, in any case, guarding against binding of the wire between the punch on top of the wire and the spring pad beneath the wire, for this would inhibit proper self-adjustment and location of the wire on the pilot.

In Fig. 15 the punch 88 has descended far enough to bring the wire onto the stationary die 132. In Fig. 15 the punch is about to begin the shearing or severing operation. At this time the wire is bound between the punch and die but, of course, has already piloted itself on pilot 144. Fig. 15 corresponds substantially to Fig. 8, just as Fig. 13 corresponds to Fig. 7.

In Fig. 16 the punch 88 has moved to lowermost position and has sheared the wire 14 from the endmost element 146 resting on the die 132. This figure corresponds to the showing in Fig. 9.

The apparatus as so far described is adapted to operate on a wire having serrated edges and no fin. In practice, however, the wire is preferably formed by a rolling operation which leaves a thin fin of metal in the serrations, this fin being indicated at 156 in Fig. 17. The punch and die are accordingly further arranged to cut away the fin, thus leaving the endmost portion of the wire in serrated condition, preparatory to severance of the endmost element 146 on the shear line 158.

Referring to Fig. 6 the die holder 130 carries not only the stationary die portion 132 previously referred to, but two additional stationary die portions 160, these including the pointed parts 162 located between the punch heel receiving surfaces 160 and 164 of the spring pad 134. Thus the punch is provided with four heels, two being the heels 148 previously referred to which bear against the spring pad at 150, and the other two bearing against the spring pad at 164. The punch is cut away or channeled at its sides to fit around the stationary die portions 162.

Figs. 10, 18, and 19 are taken approximately in the plane of the line 10—10 of Fig. 6. Referring to Fig. 10, the punch 88 is shown in raised position, it clearing the wire 14. The latter rests on spring pad 134 which at this point is narrow, it being cut away to slide between the stationary die portions 162. It will be noted that the fin on wire 14 overlies the stationary die portions 162.

Referring now to Fig. 18 the punch 88 has descended and its heels have lowered the spring pad 134, so that there is clearance beneath the wire 14. The wire has been carried down until the fins 166 rest on stationary die portions 162. This corresponds to the beginning of the fin-cutting operation. In Fig. 19 the punch has descended to lowermost position, thus shearing the wire 14 from the fins 156, the latter being restrained against downward movement by the stationary die portions 162.

This punch arrangement for cutting away the fin may also be used if necessary to cut through the full thickness of the wire or, in other words, to form the notches or serrations in the side edges of the wire. Thus the wire fed to the machine may have smooth edges with only the projections and recesses preformed therein. However, it is preferable to supply a wire with serrated edges as here illustrated.

Reverting to Figs. 6 and 10, compressed air is supplied through openings 166 in die holder 130. The air is thus led to nozzles 168 securd on top of the die with their ends 170 adjacent the punch 88 at the fin-cutting station. In Fig. 6 the nozzles have been removed, but they are shown at 168 in

Fig. 4. The compressed air flows through passages 172 to relatively small discharge openings 174 which are directed against the sides of the punch and against the scrap or fin. A larger component of the compressed air is directed outwardly through openings 176 which lead into the scrap discharge channels 178. This helps carry the scrap along. It also tends to reduce pressure in channels 178, which is effective to draw the air from nozzles 174 outwardly, and with it the tiny triangular bits of scrap outwardly, as is most clearly shown in Fig. 19.

Reverting to Fig. 10, the passages 178 communicate with holes 180 in the die block 130. These holes 180 for the discharge of scrap are elliptical or elongated, as is clearly shown in Fig. 6, and is also shown in Fig. 4. In the latter figure the compressed air supply pipes 182 are shown, these pipes leading from a suitable source to the openings 166.

From consideration of Fig. 6, it will be seen that there are no loose or severed elements between the wire and the endmost element which is being attached to the tape. This will also be clear from inspection of Fig. 17 in which the endmost element 146 is integral with the wire when the wire is being fed to the tape, and is severed from the wire only after being moved against the tape. Thus prior to the severing operation there are no loose elements, and after the severing operation there is only a single severed element, but this is astride the tape and is under the con trol of the clamping jaws. The latter preferably operate after the severing operation in order to free jaws from the metal of the next succeeding element before attempting to close the jaws. Because of the absence of loose elements there is no need for so shaping the elements as to establish an undercut or interlocking relation therebetween, and instead the outline 158 of the head of the element may take the simple divergent form shown.

If the notches are rounded somewhat, instead of being provided with a sharp point, and if the cutting punch follows the outer wall of the jaws, then small points of metal will be left on the outer ends of the jaws at the places marked 190. However, I consider it slightly preferable to round or dull, rather than point the end of the jaw, and the punch therefore turns outwardly, thus leaving slight projections of metal at the points 180 on the outside of the jaws of the element. This projection of metal is so slight in size that it is readily flattened by the action of the clamping jaws when the elements are being clamped on the tape.

It is believed that the construction and operation of my improved apparatus for severing and attaching fastener elements, as well as the many advantages thereof will be apparent from the foregoing detailed description thereof. Slide fastener wire is fed into the machine, said wire having projections on its upper side and recesses on its lower side and having serrated edges with a residue of fin therealong. The pitch or distance between the projections and recesses is only a small fraction of the length of the elements. the elements being nested together in a substantially scrapless manner, the only scrap being the fin at the serrated edges. The wire is intermittently fed toward the tape by the feed dog. The tape is intermittently moved by the tape feed wheel. The punch bears against the wire immediately around the endmost element, the latter resting on a stationary die surface, so that the punch shears the wire downwardly away from the endmost element. Immediately thereafter the clamping jaws close the jaws of the element on the tape, and the wire feed dog moves back, the wire being held below the dog by the punch.

The pilot on the die insures accurate location of the element relative to the die as it is being cut, and the location is not dependent on the extent of feed by the feed dog. The wire is so operated upon that it is free to self-adjustably seat itself accurately on the pilot, there being no restraint by either punch or the feed dog at the instant of piloting. Triangular bits of scrap may be cut from the side edges of the wire by the same punch and are cleared away from the punch by two divergent compressed air streams. The reciprocating parts of the machine are kept small in stroke and light in weight, thus making possible operation at very high speed.

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made without departing from the spirit of the invention as sought to be defined in the following claims.

I claim:

1. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die portion having an external configuration conforming to the shape of the head portion of an element with spread jaws, a pilot projecting upwardly on said die portion and adapted to be received in the recess of an element, a spring pad normally elevated to a position higher than the pilot, a punch over said spring pad having a part mating with the stationary die portion for severing an integral strip of embryo elements from the element overlying said die portion, and heels on said punch for bearing against said spring pad, said heels being of such length as to prevent squeezing of the strip between the punch and the pad, whereby said strip is free for self-adjustable seating on the pilot until the cutting action of the punch begins.

2. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die portion having an external configuration conforming to the shape of the head portion of an element with spread jaws, a pilot projecting upwardly on said die portion and adapted to be received in the recess of an element, a spring pad normally elevated to a position higher than the pilot, a punch over said spring pad having a part mating with the stationary die portion for severing an integral strip of embryo elements from the element overlying said die portion, a feed dog for feeding the strip, and means limiting the downward movement of the feed dog to an intermediate elevation such that said dog is at least partially disengaged from said strip when the punch has forced the strip onto the pilot, said feed dog being pivotally mounted to afford upward movement above said intermediate elevation when the spring pad raises the strip for forward feed above the pilot.

3. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die portion having an external configuration conforming to the shape of the head portion of an element with spread jaws, and having an internal configuration conforming to a beaded tape on which the element is to be attached, a pilot projecting upwardly on said die portion and adapted to be received in the recess of an end element, a spring pad normally elevated to a position high-

er than the pilot, a punch over said spring pad having a part mating with the stationary die portion for severing an integral strip of embryo elements from an end element overlying said die portion, clamping jaws for clamping the severed element on the beaded edge of the tape, a feed dog for feeding the strip, and means limiting the downward movement of the feed dog to an intermediate elevation such that said dog is at least partially disengaged from said strip when the punch has forced the strip onto the pilot, said feed dog being pivotally mounted to afford upward movement above said intermediate elevation when the spring pad raises the strip for forward feed above the pilot.

4. Apparatus for the manufacture of slide fasteners, said apparatus comprising a stationary die portion having an external configuration conforming to the shape of the head portion of an element with spread jaws, a pilot projecting upwardly on said die portion and adapted to be received in the recess of an element, a spring pad normally elevated to a position higher than the pilot, a punch over said spring pad having a part mating with the stationary die for severing an integral strip of embryo elements from the element overlying said die portion, heels on said punch for bearing against said spring pad and of such length as to prevent squeezing of the strip between the punch and the pad, whereby said strip is free for self-adjustable seating on the pilot until the cutting action of the punch begins, a feed dog for feeding the strip, and means limiting the downward movement of the feed dog to an intermediate elevation such that said dog is at least partially disengaged from said strip when the punch has forced the strip onto the pilot, said feed dog being pivotally mounted to afford upward movement above said intermediate elevation when the spring pad raises the strip for forward feed above the pilot.

5. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire having a series of interlocking means, a single punch movable transversely of the wire to sever the wire from a piece of the wire projecting beyond the punch, the outline of the punch being such as to provide a notching portion and a severing portion so that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the element previously severed therefrom, the notching portion cooperating with stationary die surfaces beneath the wire at opposite sides of the spring pad for removing small triangular-shaped pieces of scrap metal, air blast means for helping remove the small triangular pieces of scrap, said means including an air inlet, an air and scrap outlet, a first nozzle extending from said inlet to a point above the pieces of scrap at the opposite sides of the punch for blowing the scrap toward the outlet, and a second nozzle extending from said inlet outwardly in the direction of scrap discharge to said outlet.

6. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire having serrated side edges, the serrations of which carry a comparatively thin fin, said wire also having a series of interlocking means, a single punch movable transversely of the wire to sever the wire from a piece of the wire projecting beyond the punch, the outline of the punch being such as to provide a notching portion and a severing portion so that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a spring pad beneath the punch to restore the wire to the element previously severed therefrom, the notching portion cooperating with stationary die surfaces beneath the wire at opposite sides of the spring pad for removing the triangular-shaped fins or scrap metal, air blast means for helping remove the small triangular pieces of fin or scrap, said means including an air blast, an air and scrap outlet, a first nozzle extending from said inlet to a point above the pieces of scrap at the opposite sides of the punch for blowing the scrap toward the outlet, and a second nozzle extending from said inlet outwardly in the direction of scrap discharge to said outlet.

7. In apparatus for the manufacture of slide fasteners by severing the same from a strip, with the accompanying production of small pieces of scrap or waste at the severing station, an air flow means using compressed air to help insure discharge of the scrap, said means including a compressed air inlet, an air and scrap outlet extending away from the severing station, and a nozzle extending from said inlet outwardly in the direction of scrap discharge and joining said outlet at a point spaced from said severing station, said nozzle blowing air outwardly through the outlet and thereby tending to move the scrap through the outlet.

8. In apparatus including a punch and die for the manufacture of slide fasteners by severing the same from a strip, with the accompanying production of small pieces of scrap or waste, an air flow means using compressed air to help insure discharge of the scrap, said means including a compressed air inlet, an air and scrap outlet extending away from the punch and die, a first nozzle extending from said inlet to a point immediately adjacent the punch and die for agitating and blowing the scrap away from the die, and a second nozzle extending from said inlet outwardly in the direction of scrap discharge to said outlet for blowing air outwardly through the outlet and thereby tending to draw the air from the first nozzle and with it the scrap into the outlet.

9. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a wire, a single punch and die mechanism to sever the wire, the outline of the punch being such as to provide a notching portion and a severing portion such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, the notching portion acting to remove a triangular-shaped piece of scrap metal at the outside of the embryo jaws, and compressed air blast means for helping transfer the small triangular piece of scrap to an appropriate receptacle, said means including a compressed air inlet, an air and scrap outlet extending away from the punch and die, a first nozzle extending from said inlet to the punch and die for agitating and blowing the scrap away from the die, and a second nozzle extending from said inlet outwardly in the direction of scrap discharge to said outlet for blowing air outwardly through the outlet and thereby tending to draw

the air from the first nozzle and with it the scrap into the outlet.

10. Apparatus for the manufacture of shaped units from a strip, said apparatus comprising means to intermittently feed the strip, a punch and die mechanism to sever the strip into units of desired outline with the formation of small pieces of scrap, and compressed air nozzle means for helping remove the small pieces of scrap, said means comprising generally horizontally disposed members extending over the die to the sides of the punch and closely fitting the sides of the punch, a generally horizontal air inlet through each member, an outlet beneath said inlet, a source of compressed air connected to each inlet, a nozzle at the inner end of each inlet directed inwardly and downwardly toward the cutting station, and a second nozzle passing downwardly through each member from the inlet to the outlet, said second nozzle extending diagonally outward to the outlet, whereby the first nozzle serves to agitate and blow the scrap away from the punch and die, while the second nozzle tends to blow the scrap outwardly.

FREDERICK ULRICH.

DEFENDANT'S EXHIBIT "BW"

G. E. Prentice Patent No. 2,116,712

Filed July 11, 1935 Patented May 10, 1938

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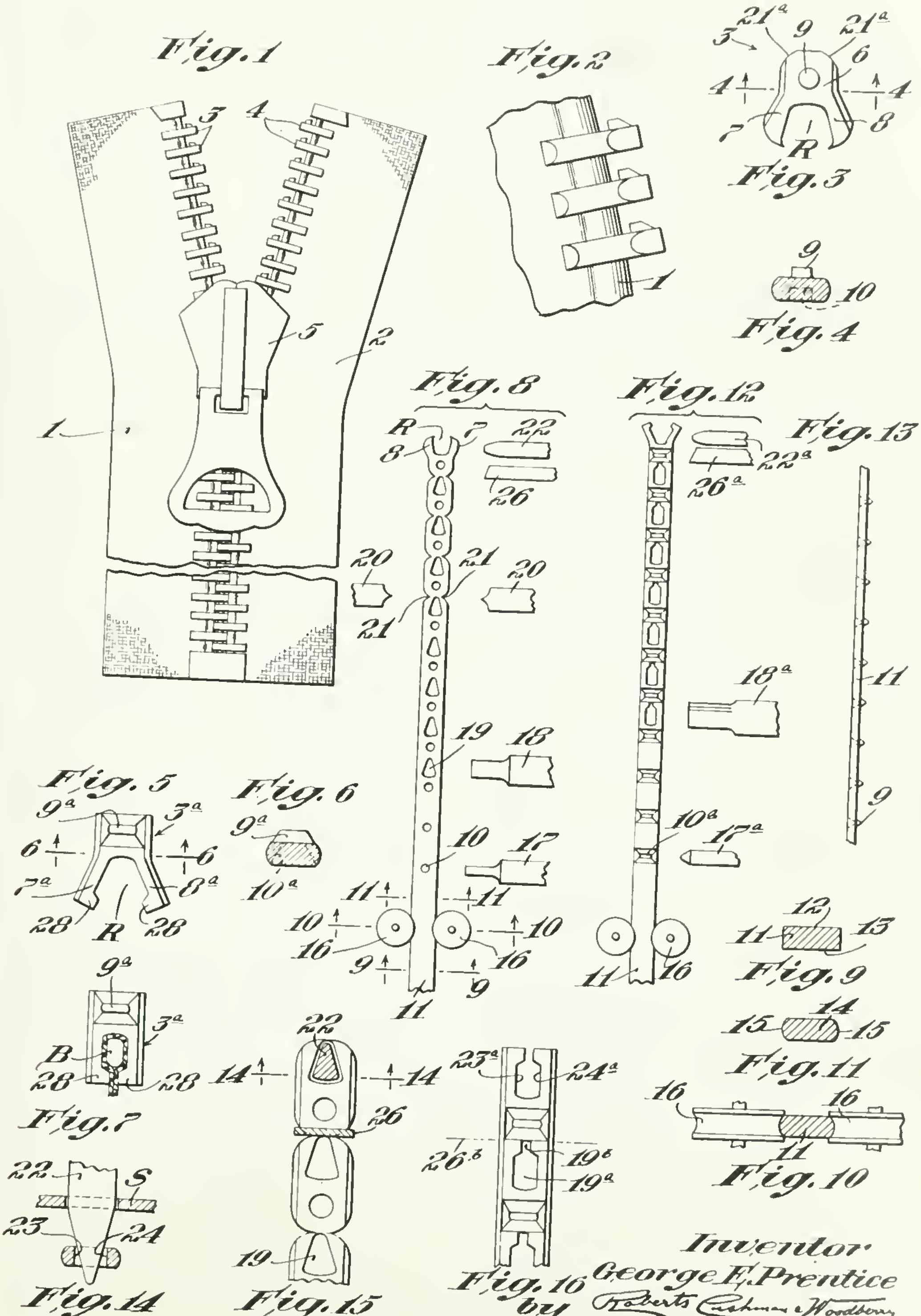
G. E. PRENTICE

2,116,712

METHOD OF MAKING FASTENER UNITS

Filed July 11, 1935



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Patented May 10, 1938 2,116,712

UNITED STATES PATENT OFFICE

2,116,712

METHOD OF MAKING FASTENER UNITS

George E. Prentice, Berlin, Conn.

Application July 11, 1935, Serial No. 30,888

6 Claims. (Cl. 29—148)

This invention pertains to separable fasteners of the kind in which opposed series of fastener units, attached respectively to the edges of flexible supports or stringers constituting the edges of a gap to be closed, are moved into gap-closing relation by means of a slider, and relates more particularly to an improved fastener unit and to a method of making such units. One common prior method of making such units has been to cut them from sheet material and the usual practice has been so to cut the unit that its legs or jaw portions are initially in divergent relation. This mode of procedure involves a very substantial waste of material, and as the corrosion-resistant metal, commonly employed in making such units, is quite expensive, this waste constitutes a large item in the cost of production.

In accordance with usual procedure, the incisions made in producing the unit are wholly within the boundary of the sheet metal from which the unit is cut, so that the entire periphery of the unit is a raw surface resulting from the action of the cutting dies. When, as is quite common in the art, the units are secured directly after cutting to the edge of the stringer, these raw surfaces of the metal, particularly if the dies have become dull, are rough and burred, and in the finished fastener the units are disagreeable to the touch and cause a harsh and noisy action of the slider.

One object of the present invention is to provide a novel method of procedure in preparing fastener units of the class described whereby waste of material is reduced to a minimum.

A further object is to provide a new method procedure which results in the production of an improved unit whose lateral edges at least are smooth and free from burrs when the units are originally formed, so that if directly attached to the stringer without any intermediate finishing operation, the resultant unit is smooth and agreeable to the touch and permits an easy and substantially noiseless movement of the actuating slider.

In the accompanying drawing I have illustrated certain desirable steps in the practice of an improved method of producing such units, as well as a desirable modification thereof, and have also illustrated the resulting improved fastener unit produced in accordance with the practice of my novel method.

Fig. 1 is a fragmentary front elevation of a slide actuated fastener of the type to which the present invention relates;

Fig. 2 is a fragmentary elevation of one of the stringers or flexible supports of such a fastener, to large scale, showing improved units made in accordance with the present invention attached thereto;

Fig. 3 is a plan view of a single fastener unit made in accordance with one desirable embodiment of the present invention, the unit being shown as it appears prior to application to the stringer;

Fig. 4 is a section substantially on the line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 3 but illustrating a unit of slightly different shape;

Fig. 6 is a section on the line 6—6 of Fig. 5;

Fig. 7 is a plan view of the unit of Fig. 5 but shown as applied to a stringer tape, the latter being in transverse section;

Fig. 8 is a diagrammatic plan view illustrating certain steps in the improved method of making fastener units of the specific type illustrated in Fig. 3;

Fig. 9 is a transverse section substantially on the line 9—9 of Fig. 8;

Fig. 10 is a transverse section on the line 10—10 of Fig. 8;

Fig. 11 is a transverse section on the line 11—11 of Fig. 8;

Fig. 12 is a view similar to Fig. 8 but illustrating a modified procedure resulting in the production of fastener units such as specifically illustrated in Fig. 5;

Fig. 13 is an edge elevation of a metallic strip or ribbon, such as is illustrated in plan view in Figs. 8 and 12, respectively, showing the strip after the completion of the cupping operation;

Fig. 14 is a transverse section, to larger scale, through the endmost section of the strip or ribbon of metal from which the units are prepared, showing the operation of the punch which exerts spreading pressure to cause the legs of the unit to diverge;

Fig. 15 is a fragmentary plan view, to large scale, showing the advancing end portion of a strip or ribbon and illustrating the operation of the spreading punch and also of the cutting off tool; and

Fig. 16 is a fragmentary plan view showing the forward advancing end portion of a strip or ribbon, such as illustrated in Fig. 12, and indicating the endmost unit in readiness to be severed and to have its legs spread apart divergently.

Referring to the drawing, the numerals 1 and 2 designate flexible stringers or supports of usual type to which the series of fastener units 3 and 4 are attached, the units of the opposed series being moved into and out of engaging relation by means of the slider 5.

As illustrated in Fig. 3, the fastener unit, in accordance with the present invention and as it appears before application to the stringer, comprises a head portion 6 and divergent leg portions 7 and 8 separated by a recess R, the leg portions 7 and 8 constituting anchoring means for securing the unit to the flexible stringer. The head portion of the unit is provided on one of its flat faces with a projecting pin 9 and is provided at its opposite face with a complemental socket or recess 10 coaxial with the pin 9.

In preparing this unit in accordance with the present invention, the first step is to provide a strip or ribbon 11 of metal of the desired character for use in forming the unit, such strip being of substantially the same width as the width of the head portion 6 of the desired unit and ordinarily having substantially flat and parallel upper and lower faces 12 and 13, respectively (Fig. 9). As illustrated in Fig. 9, this metal ribbon or strip is of substantially rectangular cross section. However, if a strip, such as shown in Fig. 9, be employed, the edges of the strip are rounded off (as shown at 15 in Fig. 11) at an early stage in the operation of making the units, preferably, as illustrated in Fig. 10, by passing the strip or ribbon between a pair of rollers or wheels 16 adapted either by compression or by abrasion to round the edges of the strip and to give them a smoothly finished appearance. Preferably the edges are rounded by pressure or the equivalent of a drawing operation so as to make these edges dense and hard and capable of withstanding considerable use without becoming rough or becoming worn by the action of the slider.

When the operation of making the units as herein described is to be carried out as a continuous process, the strip or ribbon 11 may be advanced endwise intermittently by steps each substantially equal to the length of a complete unit, first passing between the edge shaping rolls 16 and then reaching the position of operation of the cupping die 17. This die is actuated by any appropriate mechanism (not shown) and operates at regular intervals to form the recesses or sockets 10 in the upper face of the ribbon or blank,—at the same time forcing the metal at the under side of the ribbon into an outwardly projecting boss constituting the pin 9, it being understood that a suitable die at the lower side of the ribbon cooperates with the punch 17 to shape the pin 9 and give it the accurate contour necessary for the intended purpose.

The ribbon is then again advanced, and after the performance of several of the cupping operations the ribbon reaches the field of activity of the piercing die 18. This die is so arranged as to form an aperture or perforation 19 in the space between consecutive sockets 10. Preferably the aperture 19 is elongate in the direction of the length of the ribbon, and preferably it is wider at one end than at the other, the wider end being adjacent to the pin which follows it.

The ribbon now continues to advance, and after a suitable interval reaches the field of operation of a pair of oppositely moving forming tools 20, which engage the ribbon at its opposite rounded edges and indent these edges so as to form the opposed indentations or recesses 21. The forming tools 20 are of such shape that they press the metal inwardly, causing it to flow smoothly so that the walls of the indentations 21 consist of substantially unbroken portions of the original rounded edges of the ribbon. The ribbon continues to advance intermittently until the endmost of the apertures 19 is brought into the field of action of the spreading punch 22. With the understanding that this endmost aperture 19 extends to the end of the ribbon, so that the small end of the aperture is open at the end of the ribbon, the descent of the spreading punch 22 causes pressure to be exerted against the inner walls 23 and 24 (Fig. 14) of the endmost aperture, thus spreading apart the metal forming the walls of the aperture resulting in the formation of the divergent legs 7 and 8 (Fig. 3) of the unit.

As the spreading punch 22 begins to press against the side walls of the endmost aperture 19, a cutting-off tool 26 engages the ribbon on a transverse line joining the inner ends of that pair of recesses 21 which is nearest to the end of the ribbon, thus cutting off the completed endmost unit which has the appearance shown in Fig. 3. It may be noted that this transverse cut intersects the end of the next aperture 19 so that the incision made by the tool 26 frees the metal at opposite sides of the aperture 19 in readiness to be spread apart at the next operation of the spreading die 22. The endmost unit thus formed is stripped off from the spreading die 22 by means of any appropriate stripping device S, such as indicated diagrammatically at S in Fig. 14. The extreme ends of the leg portions 7 and 8 of the completed unit are sharp and prong-like, well adapted to grip the material of the stringer when the unit is applied thereto.

It may be understood that the several dies and forming tools are all operated at substantially the same time and at proper intervals so that, for example, while the cupping tool is forming the recesses 10, the piercing die 18 is forming the apertures 19, the forming tools 20 are producing the indentations 21, the spreading die 22 is acting to spread the legs of the endmost unit, while the cutting tool 26 operates at the proper time to cut off the completed endmost unit as the legs are being spread.

It will be noted that the side edges of the head 6 of the unit, as well as the outer edges of the legs 7 and 8 and parts 21ª (Fig. 3) of the end surface of the head 6 are smoothly rounded and are in fact portions of the original rounded edges 15 of the ribbon. Thus the major portion of the exposed edge of the unit, after application to the stringer, is finished and smooth so that even though the units be attached directly to the stringer as they are formed, the units present smooth surfaces for engagement by the slider so that the action of the latter is much easier and less noisy than when cut units of usual type are attached directly to the stringer without preliminary finishing.

In the arrangement illustrated in Figs. 5, 6, 7 and 12, the strip or ribbon 11, after having its edges rounded, is first caused to advance into the field of activity of a cupping punch 17ª, which is so shaped as to form a transversely elongate recess 10ª of inwardly tapering form, and at the same time to cause the metal at the opposite side of the ribbon to project and form a pin 9ª which is elongate transversely of the strip or ribbon, and which is preferably of substantially truncated, pyramidal form.

After the formation of the recess and corresponding pin, the ribbon is advanced intermittently, and after several forward steps comes into the field of activity of the piercing die 18ª. This die forms an elongate aperture 19^a (Fig. 16) of more or less rectangular contour but having at its forward end a narrow recess or bay 19^b. After the completion of the piercing operation, the ribbon further advances, but in this instance is not indented at the sides, the edge of the ribbon being left straight and continuous.

Assuming that a perforation or aperture 19^a has been formed at the advancing end of the ribbon and that the extension or bay 19^b of this aperture is open at the end of the ribbon, the advance of the ribbon brings this aperture into the field of operation of the spreading punch 22^a, which now enters the aperture 19^a, and by exerting pressure against the side walls of the aperture spreads such walls apart, causing them to assume the divergent relation shown at 7^a, 8^a, respectively, in Fig. 5. As the punch 22^a comes into action, the cutting-off tool 26^a severs the ribbon along the line 26^b (Fig. 16) so as to separate the unit from the remainder of the ribbon. By reference to Fig. 5, it will be noted that the portions of the metal at opposite sides of the narrow bay or recess 19^b now constitute prongs or anchoring elements 28 (Fig. 5) which, when the unit is compressed on the stringer, as shown in Fig. 7, press into the substance of the stringer and thus anchor the latter firmly with the beaded edge B of the stringer disposed in the bottom of the recess R. It may be noted that since the aperture 19 or 19^a is a freely open aperture, such as results from punching out and removing a portion of the metal, sufficient space is thus provided for the reception of the beaded edge of the stringer when the unit is secured to such edge, in this way permitting the divergent leg portions of the unit to be so compressed that in the finished fastener the attached portion of the unit is no wider in a front-to-rear direction than is the head of the unit (Fig. 7). This insures smooth operation of the slider and permits the slider to be made of minimum dimensions in front-to-rear thickness.

While I have herein illustrated desirable embodiments of the invention, it is to be understood that the invention is of broader application, and that while certain specific sequences of steps in the method have been described, the same steps may be carried out in other sequence without departing from the invention as set forth in the appended claims.

I claim:

1. Method of making fastener units, having smoothly rounded lateral edges, from ribbon-like material, without waste, said method comprising as steps preparing a metal ribbon having substantially flat upper and lower surfaces and rounded edges, successively cupping the ribbon, at points regularly spaced apart by distances substantially equal to the length of a completed unit, to produce sockets in one face and corresponding projecting pins on the other face of the ribbon, piercing the ribbon in the spaces between successive pins to provide elongate open apertures, projecting a spreading device into each such elongate aperture and, as the spreading device begins to act, cutting completely through the ribbon transversely at the end of the aperture nearest the pin, but without removing any substantial portion of the material of the ribbon, thereby to divide a completed unit from the ribbon and concomitantly to release the metal at opposite sides of the next aperture to permit it to be spread apart in the succeeding operation of the spreading device.

2. Method of making fastener units of the class described each having smoothly rounded lateral edges a head portion, and a pair of diverging attaching jaws, the head portion being provided with a projecting pin on one face and a corresponding socket in the opposite face, said method comprising as steps preparing a metal ribbon of a width substantially equaling the width of the head of the desired unit and of a thickness substantially equaling that of the body of the completed unit, the ribbon having parallel upper and lower faces providing the ribbon with smoothly rounded edges, successively cupping the ribbon, at points regularly spaced apart by distances substantially equal to the length of a completed unit, to produce a socket in one face and a corresponding projecting pin on the other face, piercing the ribbon to form an elongate open aperture spaced from the projecting pin and extending longitudinally of the ribbon, applying spreading pressure to the metal at opposite sides of the aperture and cutting completely through the ribbon by a transverse incision at that end of the aperture nearest to the pin, but without waste of any substantial portion of the material of the ribbon, thereby without waste to divide a completed unit from the ribbon and concomitantly to release the metal at opposite sides of the aperture so that it may be spread apart at the next actuation of the spreading means.

3. Method of making fastener units of the class described each having smoothly rounded lateral edges, a head portion, and a pair of diverging attaching jaws, the head portion being provided with a projecting pin on one face and a corresponding socket in the opposite face, said method comprising as steps preparing a metal ribbon of a width substantially equaling the width of the head of the desired unit and of a thickness substantially equaling that of the body of the completed unit and having parallel upper and lower faces and smoothly rounded edges, successively cupping the ribbon, at points regularly spaced apart by distances substantially equal to the length of a completed unit, to form a transversely elongate socket in one face and a transversely elongate projecting pin member on the opposite face, piercing the ribbon to form an elongate substantially rectangular aperture extending longitudinally of the ribbon, said aperture having a narrow extension at that end most remote from the pin, cutting completely through the ribbon by a transverse incision intersecting the narrow extension of the aperture in such a way as without waste of any substantial portion of the ribbon to divide a unit from the ribbon while concomitantly freeing the metal at opposite sides of the aperture so that the opposite side walls of the aperture may be caused to diverge, and applying spreading pressure to the inner walls of the aperture.

4. Method of making fastener units of the class described each having smoothly rounded lateral edges, a head portion, and a pair of diverging attaching jaws, the head portion being provided with a projecting pin on one face and a corresponding socket in the opposite face, said method comprising as steps preparing a metal ribbon of a width substantially equaling the width of the head of the desired unit and of a thickness substantially equaling that of the body of the completed unit and having parallel upper and lower faces and smoothly rounded edges, cupping the ribbon, at points regularly spaced apart by distances substantially equaling the

length of a completed unit, to produce the socket in one face and the corresponding projecting pin on the other face, piercing the ribbon to form an elongate aperture spaced from the projecting pin and extending longitudinally of the ribbon, indenting the round edges of the ribbon at opposite sides and at points substantially opposite to that end of the aperture most remote from the pin, severing the ribbon, without removing any substantial portion of the material as waste, by a transverse incision at that end of the aperture most remote from the pin in such a way as without waste to divide a unit from the ribbon and concomitantly to free the metal at opposite sides of the aperture so that it may be spread apart divergently, and applying pressure to the interior walls of the aperture to spread said walls apart.

5. Method of making fastener units of the class described each having smoothly rounded lateral edges, a head portion, and a pair of divergent attaching jaws, the head portion being provided with a projecting pin on one side and a corresponding socket in the opposite side, said method comprising as steps providing a metal ribbon of a width substantially equaling the width of the head of the desired unit and of a thickness substantially equaling that of the body of the completed unit, advancing said ribbon past finishing means operative smoothly to round the edges of the ribbon, successively cupping the advancing ribbon at points regularly spaced apart by distances substantially equal to the length of a completed unit, to produce spaced sockets in one face of the ribbon and corresponding projecting pins on the other face of the ribbon, piercing the advancing ribbon in each space between adjacent pins to produce elongate open apertures extending longitudinally of the ribbon, severing the ribbon by successive incisions, each cutting completely through the ribbon, which intersect the forward ends of the apertures in such a manner as without waste to divide a unit from the ribbon and concomitantly to free the metal at opposite sides of each aperture and thereby permit the metal at opposite sides of the aperture to be divergently spread, and applying spreading pressure to the opposite inner walls of said apertures in succession.

6. Method of making fastener units of the class described each having smoothly rounded lateral edges, a head portion, and a pair of divergent attaching jaws, the head portion being provided with a projecting pin on one side and a corresponding socket in the opposite side, said method comprising as steps preparing a metal ribbon of a width substantially equal to the width of the head portion of the desired unit and of a thickness substantially equaling the thickness of the body portion of a completed unit, intermittently advancing said ribbon endwise by steps each substantially equal to the length of a completed unit past a series of operating stations spaced apart distances which are substantially integral multiples of the length of a completed unit, cupping the ribbon at the first of said stations thereby to produce a socket on one face and a corespondlng projecting pin on the other face, piercing the ribbon at a later station to form an open aperture elongate in the direction of the length of the ribbon, cutting the ribbon completely through at that end of the aperture most remote from the pin, in such a way as without waste of material to divide a unit from the ribbon and concomitantly to free the material at opposite sides of the aperture, and at another station exerting spreading pressure against the walls of the aperture.

GEORGE E. PRENTICE.

DEFENDANT'S EXHIBIT "BX"
(For Identification)

J. F. Thayer Patent No. 322,997

Filed June 8, 1885 Patented July 28, 1885

(No Model.)

J. F. THAYER.

METHOD OF CUTTING STAPLES.

No. 322,997. Patented July 28, 1885.

Fig. 1.

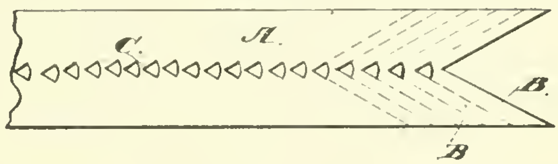
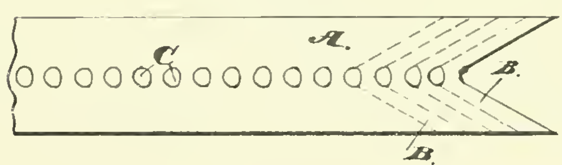


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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METHOD OF CUTTING STAPLES.

SPECIFICATION forming part of Letters Patent No. 322,997, dated July 28, 1885.

Application filed June 8, 1885. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. THAYER, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Methods of Cutting Staples; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification

My invention relates to a method of cutting staples for fastening buttons from sheet-metal blanks of the width of the finished staple, and in which the legs or prongs are at an angle with relation to each other, instead of parallel, as in the ordinary form of staple; and it consists in first removing sections from the blank at intervals to form the crown or head, and afterward cutting the staple-fasteners therefrom.

Reference is had to the accompanying drawings, in which Figure 1 illustrates the method of cutting staple button-fasteners in accordance with my invention. Fig. 2 shows the same method of producing a staple the crown of which is of different form, and Fig. 3 shows still another slight modification.

Referring to the drawings, in which like letters of reference indicate corresponding parts in all the figures, A represents the blank from which the staples are cut. B represents the staples, and C small sections of the metal which are removed from the blank to give form to the crown or head of the staple before the operation of cutting the staples is begun.

In carrying out my method I take a flat strip of sheet metal of the proper thickness and of the width of the staple to be cut, and, by means of a reciprocating die, by a drop-press, or in any other well-known manner, I remove small sections of the metal at intervals, to give the form desired to the head or crown of the fastener.

When it is desired to form a staple with a concave head on the outside and angular on the inside, I remove sections of the form shown in Fig. 1. When it is designed that the crown or head shall be flat, I remove small triangular sections, as shown at C, Fig. 2. When a fastener is to be produced with a concave crown or head only, the sections removed are of the form shown in Fig. 3.

It is evident that to change the form of the crown of the staple or fastener it will only be necessary to change the form of the die used for removing the sections from the approximate longitudinal center of the blank, so that in this manner I am enabled to produce a fastener having a head or crown of almost any desired form. After the blanks are thus prepared the staples are cut, with their legs immediately adjacent to each other, either consecutively or simultaneously and without waste of material.

As the legs of the staple or fastener are at an angle to each other, instead of parallel, as is common, and as the sides of the blank are parallel to each other, it is obvious that the cutting and pointing of the fastener is done at one and the same operation.

I do not in this application make any claim for the fastener, as I have made it the subject of a separate application filed contemporaneously herewith.

By my improved method I am enabled to produce sheet-metal fasteners in a very rapid and economical manner, with but little or no waste of material, and without specially-adapted mechanism for the purpose.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The method of forming sheet-metal staples which consists in taking a flat sheet-metal blank of the proper width and thickness, removing small sections therefrom at intervals to form the crown of the fastener, and afterward cutting and pointing the fasteners at one and the same operation, substantially as set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

JAMES F. THAYER.

Witnesses:

GEO. W. PRENTICE,

E. FISHER.